SCIENCE ABSTRACTS.

Section A.—PHYSICS.

AUGUST 1904.

GENERAL PHYSICS.

1873. *Elasmometer.* **A. E. H. Tutton.** (Roy. Soc., Proc. 72. pp. 193–195, Aug. 14, 1903.)—This is a new interferential form of elasticity apparatus. It consists of the following seven essential parts: a pair of platinum-iridium wedges against which the plate of the substance under investigation is bent; a pair of mechanical "fingers" for supporting the plate; a delicate balance; a transmitter for conveying the bending movement to the interference apparatus; an interference tripod; a measuring microscope; a control apparatus. J. W. P.

1874. *Formation of Definite Figures by Dust Deposit.* **J. Aitken.** (Roy. Soc., Phil. Trans. 201. pp. 551–558, Aug. 25, 1903. Roy. Soc., Proc. 72. pp. 211–212, Aug. 31, 1903. Abstract.)—An explanation of the figures obtained by Russell [see Abstract No. 6 (1904)]. Three causes are given: (1) Convection currents set up by the hot-plates, (2) gravitation, (3) repelling action of the hot surfaces. J. W. P.

1875. *Surface Flow in Crystalline Solids under Mechanical Disturbance.* **G. T. Beilby.** (Roy. Soc., Proc. 72. pp. 218–225, Aug. 31, 1903.)—Evidence of flow under the action of mechanical forces was observed in the case of pure metallic antimony (observations on speculum metal have already been described), but the smooth, flowed surface can be removed by lightly etching with potassium cyanide, revealing the ridges and furrows produced by the emery but disguised by the subsequent polishing with wash-leather. The forces required to produce flow in a freshly-cleaved surface of calcite are extraordinarily small; a single stroke with the finger covered with clean, soft wash-leather showed unmistakably on the etched surface, but this could be removed by further etching with 0·2 per cent. acid for 30 to 60 sec. For the theory of these changes see a subsequent paper by the same author in the Proceedings of the Faraday Society. [See also Abstract No. 92B (1904).] T. M. L.

1876. *Flow of Water through Pipes.* **H. T. Barnes** and **E. G. Coker.** (Phys. Rev. 16. pp. 377–378, June, 1903. Abstract of paper read before the

American Physical Society, April 25, 1903.)—The thermal method for measuring the critical velocity is employed. Large tank and head of water allow of a higher degree of steadiness in the flow. The results are: (1) The attainment of exceedingly high velocities of stream line flow for certain sizes of pipes fed by perfectly quiet water under a high head; (2) the re-formation of stream lines in certain cases after eddies had formed, with a subsequent breaking up at the stream lines at a very much higher velocity; (3) a small divergence from the law of the change in viscosity with temperature for the upper limit of stream line flow; (4) a verification of the viscosity-temperature law for the upper limit of stream line flow. [See also Abstract No. 1202 (1903).] J. W. P.

1877. *Testing Colloids.* **E. J. Mills** and **A. Gray.** (Soc. Chem. Ind., Journ. 23. pp. 526–528; Discussion, p. 528, May 31, 1904.)—The authors describe a physical method of testing colloids, consisting in coating a standard cotton thread with a given colloid, drying it under constant conditions and determining the modulus of elasticity of the coat. The value of this modulus is directly related to the stiffening power of the colloid. The modulus of elasticity per 1 per cent. of the colloid in the coating solution has the following values: potato starch, 35·7; maize starch, 48·4; gum arabic, 82·8. T. H. P.

1878. *Modification of Pendulum Oscillations by External Forces.* **F. v. Hefner-Alteneck.** (Preuss. Akad. Wiss. Berlin, Sitz. Ber. 40. pp. 842–851, July 30, 1903.)—Starting from Huyghens' theorem that any normal to the direction of the oscillation of a pendulum is cut by a semicircle, described above the amplitude, at a distance which is proportional to the velocity of the oscillating point at the foot of the normal, the author shows in an elementary way that any accelerating force will quicken the movement and diminish the period when it is applied in the first part of the oscillation, and will retard the movement when applied in the second part of the oscillation. He demonstrates that this holds for the air resistance, with the aid of a pendulum whose bob is replaced by a flat strip at right angles to the direction of the oscillation; a short tube is attached to the strip and closed at the far end by a piece of thin paper attached to a horizontally stretched thread. Reference is made to escapements in clockworks. When suggesting in 1888 to regulate the pendulum motion with the aid of a small weight, to be raised and dropped again by the fork, the author did not consider the importance of the point of application as explained above. H. B.

1879. *Experiments on Vortex Rings.* **A. Lampa.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 606–614, July, 1903. From the I. Physik. Inst. der k. k. Universität in Wien.)—The experiments are made in liquids and in gases. For the former, an apparatus with circular aperture, similar to that of Reusch is employed. Water, petroleum, and alcohol are used, and results for miscible liquids are found to be the same as for non-miscible. For gases similar results are attained with a different apparatus. Reflection at fixed walls, deviation and separation at the interface of two media, and analogy to Röntgen rays are shown. J. W. P.

1880. *Mechanical Theory of Friction.* **E. Daniele.** (N. Cimento, 7. pp. 109–126, Feb., 1904.)—In this work the author seeks to extend the results obtained by Painlevé (Lectures on Friction, 1895) and to give a very general theory of friction. The definition employed by Painlevé and by the writer, of friction forces is based on the hypothesis that the virtual work done by the connecting forces in any virtual displacement differs from zero. Hence are deduced the three fundamental statements: (*a*) Let ρ' denote the resistance due to the connecting forces which act at a point P of the material system in the absence of friction, that is, when the virtual work is zero, and $R = \rho' + \rho$ the corresponding resistance when there is friction. Then ρ is the friction force at P, and the virtual work of the forces ρ is the same as that of the forces R; (*b*) The elements $(\rho/m)\partial t$, m being the mass of the point P, constitute a system of virtual displacements. (*c*) $\Sigma \frac{R^2}{m} = \Sigma \frac{\rho'^2}{m} + \Sigma \frac{\rho^2}{m}$. (equation A). The material system considered may be of any form, subject only to the condition that its configuration at any instant can be expressed in terms of a finite number of parameters. But the equations may contain the time explicitly, and the system is not necessarily holonomous. The work is divided into six sections. In section (1) is considered the decomposition of R into a force of connection ρ' (forza vincolare), and friction force ρ (forza d'attrito). In section (2) are established formulæ for expressing ρ in terms of certain parameters μ, analogous to the parameters λ in terms of which ρ' is expressed. (3) Contains the minimum theorem expressed by equation A. In (4) it is shown that the coefficients λ in the expression for ρ' in terms of the parameters can be expressed as functions of the time and of the coordinates and their first derivatives according to t independently of the forces ρ. In (5) are considered two kinds of connections (vincoli). In (6) the writer considers the case of two systems of connections, one without and the other with friction, corresponding to a problem treated by Painlevé, and the relation between the resistance due to the frictionless system and the forces of the other system. S. H. B.

1881. *Decay of Oscillations and Fatigue of Elasticity.* **H. Bouasse.** (Annal. Chim. Phys. 2. pp. 5–77, May, 1904.)—Experiments are made upon the decay of torsional oscillations of wires, with a number of refinements as to mode of starting the vibration, &c. The whole curve of decrements is dealt with, and the bearing of this upon the nature and modifications of the metal is considered. J. W. P.

1882. *Rise of a Spinning-Top.* **E. G. Gallop.** (Cambridge Phil. Soc., Trans. 19. pp. 356–378, May 31, 1904.)—The air friction is neglected, and the assumptions made with regard to the friction between the top and the ground are that it may be represented by a single force at the point of contact, and that when slipping takes place the direction of the force of friction is opposite to the direction of sliding, or at any rate acts so that energy is dissipated. The treatment is mathematical, but arithmetical examples are given. *Inter alia* it is proved that the permanent state of rotation with axis vertical cannot be attained without dissipation of energy, and conversely that if sufficient energy be lost the axis must become permanently vertical. Various types of top are considered. J. W. P.

1883. *Deep-water Two-dimensional Waves Produced by any Given Initiating Disturbance.* **Kelvin.** (Phil. Mag. 7. pp. 609–620, June, 1904. From the Proceedings of the Royal Society, Edinburgh, Feb. 1, 1904.)—The case of frictionless water in an infinitely long, infinitely deep, straight canal is considered. Numerical results are given showing the forms and magnitudes of the waves. J. W. P.

1884. *Heat Exchange in the Soil, the Water, and the Atmosphere.* **J. Schubert.** (Deutsch. Phys. Gesell., Verh. 6. 9. pp. 173–175, May 15, 1904.)—According to W. v. Bezold the heat content of the soil per unit area down to a depth H of uniform temperature, is $\int_0^H C\,(t-t_0)dh$, where t_0 is the starting temperature, t the momentary temperature, and C the heat capacity. For the atmosphere, the heat content is $\int_0^H \rho c_p(t-t_0)dh$, or, introducing the air-pressure b, $1\cdot36\,c_p\int_0^{760}(t-t_0)db$; to this is to be added, $1\cdot36\,.\,0\cdot6\int_0^{760}(y-y_0)db$, where y is the specific humidity in gm. per kg. of air. From observations made in the soil at Eberswalde, in the atmosphere near Berlin from balloons, and in the sea-water at Danish lightship stations in the North Sea and Baltic, the author deduces the following values for the annual heat exchange in gm.-cals.: Sandy soil, 1,850; atmosphere (without heat of vapour) 2,620; atmosphere (with heat of vapour), 3,600; sea-water, 4,400. The figures mark the strong influence of the sea on the climate; the daily heat exchange is much greater in the water than in the soil, as has further been shown at Heringsdorf (Baltic) and in Finland (by Homén). From cloud observations it would result that, up to altitudes of 10 km., the velocity v of the air currents is, for an altitude of H km., $v = (5\cdot5 + 2\cdot5\text{ H})$ m. per sec. If all the energy of motion were converted into heat, the air temperature would rise by 0·3°. The velocity of the air currents seems to be greatest for an altitude of about 7 km., but the greatest amount of aqueous vapour which passes through a vertical cross-section flows within an altitude of 1 km. These researches have been published as a pamphlet by J. Springer. H. B.

1885. *Meteoric Dusts in New South Wales.* **A. Liversidge.** (Roy. Soc. N.S. Wales, Journ. and Proc., 36. pp. 241–285, 1902.)—The author gives descriptions and analyses of meteoric or atmospheric dusts, notably of specimens which fell at Moruya on December 15, 1880, and of dust collected from the beams underneath the roof, and in a cistern of the University and Observatory buildings at Sydney. The Moruya dust, like several specimens, seemed to be essentially of terrestrial origin, and to have come from dried-up, fresh-water pools; but the 0·009 gm. of magnetic matter, and possibly also some earthy matter in the 27·5 gm. of dust, were probably meteoric. The 4·94 gm. of roof dust contained 1·5 per cent. of magnetic matter, metal or oxide of iron with both cobalt and nickel. The tank dust had apparently been accumulating for thirty years. The traces of gold and platinum found may also be meteoric. Discussing the dust finds of Tissandier (Tower of Notre Dame, Paris), Nordenskjöld (Arctic snows), A. Schroster (African deserts), and others, the author concludes that the presence of cobalt and nickel in iron is not a proof of its meteoric character. Both these metals occur in commercial iron, have been found in the soot from coal by H. Hartley and H. Ramage, and G. C. Hoffmann has discovered them also in the spherulitic iron of St. Joseph Island, Lake Huron. Gentle falls of meteoric dust are, no doubt, frequent, but they do not cause our ordinary dust storms, hazes, ash and mud rains, &c. A large portion of the paper is taken up by references to dust storms and similar phenomena observed in Australia and all over the world. A very remarkable dry fog travelled rapidly over an immense area of the Murrurundi district on October 12, 1876; no dust was collected in this case. H. B.

1886. *Sun-spot Minima and Volcanic Eruptions.* **H. I. Jensen.** (Roy. Soc. N.S. Wales, Journ. and Proc., 36. pp. 42–60, 1902.)—The reawakening of volcanic activity in recent years induces the author to examine the records and the possible relations between earthquake and other phenomena, and he confirms Kluge's hypothesis, based upon a study of the period 1850 to 1857, that volcanic eruptions (and also magnetic disturbances) are most noticeable in times of sun-spot minima. In predicting earthquakes we have to consider lines of weakness and of faulting in the earth's crust with regard to the phase, sun-spot minima with regard to the period, the relative position of earth, moon, and sun with regard to the season, and possibly cyclones and atmospheric pressure with regard to the day. Briefly surveying the various hypotheses, the author expresses the opinion that at sun-spot minima less energy is received from the sun, and more heat (and perhaps magnetism) radiated from the cooler earth, particularly owing to the absence of the usual protective canopy of moisture. The statistics concern the whole world since 1811, and more especially Vesuvius (since 1776), Etna, and the volcanoes of Hawaii. H. B.

1887. *The Boogaldi, Barratta Nos.* 2 *and* 3, *Gilgoin Nos.* 1 *and* 2, *and Eli Elwah or Hay Meteorites, New South Wales.* **A. Liversidge.** (Roy. Soc. N.S. Wales, Journ. and Proc. 36. pp. 341–359, 1902.)—The Boogaldi meteorite, found in 1900, and described by R. T. Baker, resembles the Bingera meteorite; it weighs 2,057·5 gm., density 7·85, is regularly pear-shaped and covered with a skin of fused oxide which forms well-defined concentric waves at the thick (front) end from which transverse furrows run to the thin end. A section etched with copper sulphate or bromine shows the crystalline structure very well; there are only a few specks of troilite, but some pits, formerly filled by troilite probably, and also some gas-bubble pits. The elements found are Fe (91 per cent.), Ni (8), Co (0·5), Mn (?), Cr, Cu (0·28), Sn (?), As, Au, Pt (or some other platinum metal), C, P, S. The Barratta meteorites, weighing 48 and 31 lbs., fell about 1860; in 34·5 gm. were found 6·13 per cent. of metal; the non-metallic constituents are silica 41·7 per cent., iron oxides (25·7), magnesia (25·8), lime (2·7), alumina (1·2), nickel (oxide ?, 0·481), sodium oxide (0·6), sulphur (2). The one Gilgoin meteorite weighing 67 lbs., density 3·85, contained in 34 gm. 14·7 per cent. of nickel iron; the other seems to be similar in composition. The density of the Elwah meteorite is 3·537. Photographs are given. H. B.

1888. *Spectroscopic Observations of the Rotation of the Sun.* **J. Halm.** (Roy. Soc. Edinburgh, Trans. 41. 5. pp. 89–104, May 4, 1904.)—The research was undertaken in hope of gaining new material for discussing the law of the sun's rotation, which has hitherto been mainly dependent on observations of sun-spots, thereby precluding from the discussion the polar regions of the photosphere, where sunspots rarely or never occur. Observations were made of the displacements shown by the Fraunhofer lines at opposite limbs of the solar disc, the instrument employed being a diffraction grating spectroscope of great power. To increase the stability of the apparatus, the sunlight was thrown into the condensing lens from a siderostat. To obviate the use of double reflecting prisms for the comparison of the two opposite limbs of the sun, the author employed a heliometer, and by separating the two components of the objective he could place any two diametrical points on the sun's limb in juxtaposition on the slit plate. A position circle was used to determine the exact orientation of the points examined, and it was of course necessary to introduce a small correction for the rotation of the field, which is a well-known feature of the siderostat. The spectroscope consisted of a collimator of 4 in. aperture and 50·5 in. focal length, passing the light to a plain Rowland grating 5 in. long and 3½ in. wide, with 14,438 lines to the inch. The third order spectrum was then examined with a viewing telescope of 4·1 in. aperture and 60 in. focal length, and fitted with a Cooke wire micrometer. The observations have extended over the period 1901, August 13 to 1903, November 6, during which time 564 determinations of the rotational velocity were made. These have been divided into two groups for discussion, according to their epoch with respect to the solar cycle of spot activity. Curves plotted from the results obtained are given, from which it is at once evident that the two groups differ materially from each other. Agreeing fairly well near the equator, the rotational velocities near time of maximum activity show greater values in higher latitudes than the velocities of similar latitudes at times of minimum spot activity. The following formula has been found to fulfil the conditions of the various groups of observations: $\xi = a - bc^{\beta}$, where ξ is the angular velocity in latitude β, and a, b, and c are constants. [See also Abstract No. 1296 (1902).] C. P. B.

REFERENCES.

1889. *Some Peculiarities of the Gyroscope.* **G. B. Warring.** (Science, 17. pp. 861–862, May 29, 1903. Paper read before the New York Academy of Sciences, Astronomy Section, May 4, 1903.) G. E. A.

1890. *A Short Glycerine Barometer.* **U. Behn** and **F. Kiebitz.** (Phys. Zeitschr. 4. pp. 543–545, July 15, 1903. Laborat. des Physik. Vereins, Frankfort, July 6, 1903.)—The authors describe the construction and calibration of an open-scale, short, glycerine barometer which gives very accurate readings.

1891. *Outflow of Liquids from Apertures.* **J. Hermanek.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 879–925, July, 1903.)—A mathematical consideration in which the influence of friction and of air resistance and the effects of different apertures (circular, rectangular, square) are dealt with. J. W. P.

1892. *Deformations of Solids.* **H. Bouasse.** (Annal. Chim. Phys. 29. pp. 384–417, July, 1903.)—This is in continuation of work previously published [see Abstract No. 1021 (1902)]. The author has altogether issued nine memoirs—a list of which is given—that extend to over 900 pages of proceedings on the subject. The present instalment chiefly consists in a review of the past work. W. W. H. G.

1893. *The Laws of Tenacity.* **G. Kuntze.** (Ann. d. Physik, 11. 5. pp. 1020–1046, July 7, 1903. Extract from the Göttinger Inaugural Dissertation.)—Measurements have been made of certain physical properties of a mixture of gypsum and stearic acid. The results are compared with those demanded by theory. W. W. H. G.

1894. *Effects of Heat and of Solvents on Thin Films of Metal.* **G. T. Beilby.** (Roy. Soc., Proc. 72. pp. 226–235, Aug. 31, 1903.)—Films of gold or silver acquire a very high electrical resistance and become almost transparent when annealed. They can, however, be restored to their original condition by pressing or burnishing. T. M. L.

1895. *Sensibility of the Azimuthal Balance.* **V. Crémieu.** (Comptes Rendus, 138. pp. 1090–1093, May 2, 1904.)—A mathematical consideration, in which it is shown that the sensibility has a finite maximum. [See Abstract No. 1314 (1904).] J. W. P.

1896. *Aerodynamic Phenomena.* **J. Violle.** (Comptes Rendus, 137. pp. 397–398, Aug. 17, 1903.)—The effects produced by the discharge of a certain type of cannon are described, and the connection to Charbonnier's and Sebert's work pointed out. J. W. P.

1897. *Effect of Temperature on Torsional Rigidity of Wires.* **F. Horton.** (Roy. Soc., Proc. 73. pp. 334–336, May 28, 1904.)—Temperature ranged from 15° to 126°, and the oscillation method was employed. Results on the viscosity are also described. J. W. P.

1898. *Contact of Solid Elastic Bodies.* **M. T. Huber.** (Ann. d. Physik, 14. 1. pp. 153–163, May, 1904.)—A mathematical treatment. J. W. P.

1899. *Nature of Radio-active Bodies.* **F. Re.** (Comptes Rendus, 136. pp. 1393–1395, June 8, 1903.)—The atoms are regarded as analogous to solar systems formed by the condensation of minute nebulæ. In most cases the contraction of the nebular system is complete, but not in the case of the larger systems which constitute the radio-active elements. In this way an explanation is given of (1) the high atomic weight of the radio-active elements, and (2) the liberation of energy which would be due to the contraction of the atoms. The energy liberated by radio-active bodies may thus be regarded as constituting a portion of the heat of formation of the atoms rather than the heat of decomposition. T. M. L.

1900. *Ocean Currents.* **H. C. Russell.** (Roy. Soc. N.S. Wales, Journ. and Proc. 36. pp. 201–210, 1902.)—This is the seventh of a series of memoirs on ocean currents presented by the author under the title "Current Papers" [see Abstract No. 194 (1903)]; records of papers Nos. 752 to 926 are tabulated. In one case a bottle drifted in the Arabian Sea at the rate of 29·2 miles per day, this rate having been surpassed three times, when rates of 32·5 (?), 31, and 29·5 miles were observed. One bottle drifted from the neighbourhood of the Falkland Isles eastward to West Australia—a distance of 9,020 miles—at the rate of 9·3 miles per day; the longest record is 9,585 miles. South of Australia the drift is eastward. Icebergs are also mentioned. H. B.

1901. *Estimation of Argon in Atmospheric Air.* **H. Moissan.** (Comptes Rendus, 137. pp. 600–606, Oct. 19, 1903.)—The author, after referring to the various attempts to estimate the quantity of argon in air, points out the advantage of using metallic calcium for absorbing the oxygen and nitrogen, and also describes the method of securing uniform samples of moist air, the arrangements and precautions being detailed. A table is then given showing the amount of argon present in samples collected at different places in various parts of the world. The lowest value, 0·9305 per cent., was obtained in Martinique, and the highest, 0·9492 per cent., on the Atlantic Ocean, but no other value is higher than 0·9385 (Vienna); the values for Mont Blanc samples (4,810 m.) are practically the same as for Paris, London, and Berlin (about 0·9327, mean). L. H. W.

1902. *Presence of Argon in the Gases of the Martinique Furneroles.* **H. Moissan.** (Comptes Rendus, 138. pp. 936–938, April 18, 1904.)—The author gives analyses of samples of the gases collected by A. la Croix, the argon being estimated by means of metallic calcium [see preceding Abstract], there being 0·73 and 0·68 per cent. argon respectively in the two samples quoted. L. H. W.

1903. *Denucleation of Air over Water.* **C. Barus** and **A. E. Watson.** (Amer. Journ. Sci. 17. pp. 392–394, May, 1904.)—If air containing nuclei from any source whatever is introduced into a cylindrical condensation chamber over pure water, and if the cylinder is rotated on its axis more or less rapidly without further interference with the air contained, the charge of moist air will soon be found to be free from nuclei. The nuclei are lost by the continued bubbling of the air enclosed within the cylinder through the contained water. J. J. S.

1904. *Structure and History of the Lunar Crust. Observations from Lunar Photographs.* **Lœwy** and **P. Puiseux.** (Comptes Rendus, 136. pp. 1505–1511, June 22, 1903.)—The authors point out that observations taken in the neighbourhood of full moon are lacking in detail unless special precautions are taken. They also show that volcanic disturbances on the moon have been more general and more violent than on the earth. The relative ages of the districts penetrated by the ridges radiating from the craters are deduced. According to this, Tycho's eruptions took place before those of Kepler or Copernicus. A rare and dry atmosphere once existed, and the rectilinear radiation of volcanic cinders shows the absence of cyclonic disturbances. Several points of topography and altitude are touched upon. H. F. H.

1905. *Miscellaneous Radial Velocity Determinations with the Bruce Spectrograph.* **W. S. Adams.** (Astrophys. Journ. 18. pp. 67–69, July, 1903.)—In the case of 61 Cygni both components were found to have a velocity of −63 km., and this fact considered in connection with their similar proper motions would seem to indicate that the two stars are unquestionably physically connected. The radial velocity of ε Ursæ Majoris was found to be −9·4 km., and as the photographs were taken over a year it would appear that no appreciable change took place during this time. The Potsdam value for this star was −30·4 for the epoch 1889·39; it is possible that the star is a binary of much longer period than any met with hitherto. The star β Scorpii, of the Orion type, showed a variable velocity between +19 km. and −99 km. Some preliminary observations on ε Herculis showed a variable velocity lying between −22 km. and −58 km. E. C. C. B.

1906. *Observations of Solar Radiation.* **H. H. Kimball.** (Monthly Weather Rev. 31. pp. 320–334, July, 1903.)—The observations given in this lengthy paper were made by means of the Ångström pyrheliometer at Asheville. A full description of the testing of the instruments and the results, together with curves showing the diurnal radiation, are given. [See also Abstract No. 989 (1904).] E. C. C. B.

1907. *Cause of the Nebulosity around Nova Persei.* **F. W. Very.** (Amer. Journ. Sci. 16. pp. 49–60, July, 1903.)—The author discusses various hypotheses to account for the nebulosity around the Nova, and considers that the following one only can be possible in view of the known facts, namely, the actual movement of diamagnetic ions under the control of magneto-electric impulses emanating from the star and following the lines of magnetic force. The light may be produced by the phosphorescence of dark matter previously existing in the dark space, and made luminous by colliding ions, or the moving ions may themselves be luminous. The author considers the latter condition more probable, but points out that only spectroscopic evidence can decide which of the two conditions obtains. [See Abstract No. 1298 (1904).] E. C. C. B.

LIGHT.

1908. *Diffused Reflection of Light from Dull Surfaces.* **F. Thaler.** (Ann. d. Physik, 11. 5. pp. 996–1019, July 7, 1903. Abstract of Kieler Inaugural Dissertation.)—Observations are made on dull glass, magnesium oxide, &c.; and for values of the three angles (incidence, emanation, and azimuth), the brightness is measured. The validity of Lambert's formula is thus tested. For the same angle of incidence, the brightness diminishes generally with increasing angle of azimuth. The measurements are taken by the method of Seeliger and Wright. J. W. P.

1909. *Extinction of Light by Normal Dispersion in an Optically Homogeneous Medium.* **M. Planck.** (Preuss. Akad. Wiss. Berlin, Sitz. Ber. 22. pp. 740–750, April 21, 1904.)—A mathematical consideration based on electromagnetic theory. Comparison with Rayleigh's theory is made. J. W. P.

1910. *Electromagnetic Theory of Light.* **P. Drude.** (Gesell. Wiss. Göttingen, Nachr., Math.-Phys. Klasse, 1. pp. 1–8, April 30, 1904.)—A mathematical contribution for active bodies. Various crystals are considered. The results of Pocklington and Voigt are dealt with. J. W. P.

1911. *Thickness and Index of Refraction of Plates.* **J. M. de Lépinay** and **H. Buisson.** (Annal. Chim. Phys. 2. pp. 78–108, May, 1904.)—A new method for these measurements by interference fringes is described. Results lead the authors to believe that a thickness can be measured to $\frac{1}{100}$ of a micron. The thickness being known, the index is then obtained. J. W. P.

1912. *Relation between Refractive Index and Density of Air.* **L. Magri.** (Accad. Lincei, Atti, 13. pp. 473–481, May 1, 1904.)—From a full investigation of the relation between the refractive index and density of air at pressures up to 176 atmospheres, the author concludes that the refractive index increases more rapidly with increase of density than is required by Gladstone and Dale's formula, $(n-1)/d = \text{constant}$, but that with the exception of values for pressures below 30 atmospheres, at which great accuracy is not obtainable, the formula $(n^2-1)/(n^2+2)(1/d)$ is practically constant. W. H. Si.

1913. *Intensity of Natural Radiation from Moving Bodies and its Mechanical Reaction.* **J. Larmor.** (Phil. Mag. 7. pp. 578–586, May, 1904. Reprinted from the Boltzmann-Festschrift.)—The question of radiation-pressure as producing a retarding force when the radiating body is in motion is treated mathematically, and Poynting's result is considered. The motion of a material body is shown not to affect the pressure on it exerted by the ambient radiation. J. W. P.

1914. *Double Refraction and Elasticity of Gelatine Plates.* **A. Leick.** (Ann. d. Physik, 14. 1. pp. 139–152, May, 1904. Extract from the Greifswalder Dissertation.)—The preparation of the plates is first described and then the measurements. Tables of results are given and relations between the two quantities. J. W. P.

1915. *Reflecting Power of Selenium.* **C. K. Edmunds.** (Phys. Rev. 18. pp. 385–402, June, 1904.)—The measurements are made by the spectrophotometer and are confined to the visible regions of the spectrum. Ordinary light and polarised light are considered. There is in general an increase in the reflecting power as the wave-length of the incident light is decreased. J. W. P.

1916. *Surface-tension in Photography. New Action of Light.* **G. Quincke.** (Ann. d. Physik, 11. 5. pp. 1100–1120, July 7, 1903.)—The slow action of light on oily silver bromide-glue in unmatured silver bromide-gelatine must be distinguished from its rapid action on silver bromide in the ripened gelatine. The ripening process of silver bromide-gelatine corresponds with the flocculation or "breaking" of turbid solutions. The chemical action of light on silver bromide is a resonance phenomenon; the silver bromide particles are more readily decomposed, the greater the amplitude of the vibrating particles, and, when the light waves have the same energy, the smaller the mass of the vibrating particles. For the experimental data and theoretical considerations supporting these views recourse must be had to the original. T. H. P.

1917. *Dispersion in Water and Carbon Disulphide.* **E. Flatow.** (Ann. d. Physik, 12. 1. pp. 85–106, July 21, 1903. Extract from the Berliner Inaugural Dissertation.)—The effect of temperature on the dispersion of visible and ultra-violet radiation is investigated, Micheli's photographic method being employed. On applying the Ketteler-Helmholtz dispersion formula to Simon's results for water, a want of agreement was found to exist between the observed and the calculated values. This was ascribed to an error in the wave-lengths. Tables are given of the relative and absolute refractive indices of water for waves between $\lambda 214$ and $\lambda 589$, and for temperatures between 0° and 80°, and of carbon disulphide for waves between $\lambda 267$ and $\lambda 589$ from $-10°$ to $+40°$. The results obtained show that the simpler formulæ connecting density and refractive index do not give sufficiently approximate values of the latter quantity. Further, the dispersion of liquids diminishes, and that of solids increases, with rise of temperature; and the variation of refractive index with temperature of liquids is due chiefly to the change of density, the temperature coefficient at constant volume being almost zero. G. E. A.

1918. *Causes, Composition, and Destruction of Photographic Fog.* **A.** and **L. Lumière** and **A. Seyewetz.** (Photographic Journ. 43. pp. 223–226, and pp. 226–235, Aug., 1903. Papers read before the Jubilee Commemoration Congress.)—In the first paper the authors attempt to elucidate the causes and composition of the dichroic fog frequently observed in negatives after fixation. The investigation is dealt with at great length, and the conclusions arrived at are as follows: Dichroic fog may be formed during development at any time if a solvent of silver bromide is present in the developer, especially with hyposulphite of soda; also in the fixing bath, if a small amount of developer, mixed with sodium sulphite, gets in by any chance. Fog production is favoured by under-exposure, accelerators in developer, prolonged development and increase of temperature of developing bath. The nature of the gelatine and speed of the emulsion are important factors. The most frequent cause of fog is held to be the inefficient washing of plates between development and fixation. In the second paper experiments on the destruction of fog are detailed, the following being the remedies suggested: (1) Treatment of negative by ammonium persulphate, followed by fixing in bisulphite of soda (for dense fog). (2) Transformation of the silver by H_2S (for fog formed in development). (3) Neutralised permanganate of potash, followed by treatment by sulphite of soda (applies to all cases and gives best results). L. H. W.

1919. *Two Microscopic-Petrographical Methods.* **F. E. Wright.** (Amer. Journ. Sci. 17. pp. 385–391, May 1904. Michigan Geological Survey, Houghton, Michigan.)—The relative refractive index of a mineral in a section may be gauged by placing the section under a low-power microscope, and putting one-half of the field of view in shadow by placing a finger in front of the reflector. If the edge of a crystal projecting into the bright portion is brighter, or that projecting into the dark portion is darker, than the surrounding mineral, its refractive index is lower than that of the adjacent crystal, and *vice versâ*. The second method is for distinguishing the direction of optic axes in uniaxial and biaxial crystals, according to the motion of faint dark hyperbolas seen when the field is changed from the dark position. The rule given is that the dark hyperbolas leave the field in the direction of the acute bisectrix in the biaxial minerals, and of the principal axis in uniaxial minerals. G. E. A.

1920. *New Method of Colour Photography.* **A.** and **L. Lumière.** (Comptes Rendus, 138. pp. 1337–1338, May 30, 1904; Photographic Journ. 44. pp. 226–228, July, 1904.)—A quantity of potato-starch, of which the particles vary in size between 15 μ and 20 μ, is divided into three portions, which are dyed respectively orange-red, green, and violet. The colours are then dried, mixed, and spread uniformly over a glass plate coated with some adhesive. The plate is now varnished, and on the varnish is put a thin isochromatic sensitive film. The plate can be exposed and developed in the ordinary way and, if fixed, gives a transparency complementary to the object photographed. By dissolving the silver reduced during development, the image may be inverted and the colours obtained in their right order. G. E. A.

1921. *Determination of Specific Rotation by Kanonnikoff's Method.* **A. A. Panormoff.** (Jurn. Russk. Fisik. Chimičesk. Obščestva, 35. pp. 678–687, and pp. 688–690, 1903.)—The author has made a number of measurements of the rotatory power of French turpentine, *l*-pinene, cholesteral, and quinine hydrochloride in chloroform solutions. The results show that Kanonnikoff's method of deriving the specific rotation of a compound from polariscopic readings of two solutions of different concentration, and also the author's modification of this method (J. Russk. Fisik. Chimičesk, 26. p. 193, 1894), can only be applied in special cases and not generally, since the constant A employed varies with the concentration, and x depends not only on the solvent, but also on the substance dissolved. In the second paper, as the method used by the author in determining the specific rotations of proteids was incorrect, he gives new measurements to replace his previous determinations (of 1899). The new values are higher than the older ones, but the changes do not affect the conclusions previously deduced. T. H. P.

1922. *Rotivities and Refractivities of the Allyl Ethers of some Active Alcohols.* **A. Haller** and **F. March.** (Comptes Rendus, 138. pp. 1665–1669, June 27, 1904.)—The authors prepared and examined the rotivities of the allyl ethers of borneol, menthol, β-methylcyclohexanol, and linalool, with the general result that the rotivities were found to be decidedly greater than those of the active alcohols themselves. The full interpretation of the results can only be given when measurements have been made with the *propyl* ethers of the above alcohols; all attempts to prepare these ethers have so far failed. It was found that the allyl ethers gave experimental values for the molecular refractions agreeing closely with the theoretical values, so that association with the unsaturated allyl radical does not increase the refrangibility of the alcohol radical. D. H. J.

1923. *Formulæ for Spectrum Series.* **A. Fowler** and **H. Shaw.** (Astrophys. Journ. 18. pp. 21–32, July, 1903.)—The well-known formulæ of Rydberg, and Kayser and Runge can only in many cases be considered as rough approximations to the truth, and in this paper the authors discuss the modified Rydberg formulæ which have been suggested, and find that much closer values are obtained. The first of these formulæ is $n = n_{\infty} - C/(m^{p} - m_{0})$, where m takes successively the values 2, 3, 4, &c., n is the oscillation frequency, and C, n_{∞}, m_{0}, and p are constants. The second formula is $n = n_{\infty} - C/\left\{(m + \mu)^{2} - m_{\infty}\right\}$, where μ is also a constant. From results given for sodium, potassium, lithium, magnesium, and helium, it is clear that while both formulæ give very close approximations, the results given by the second are generally more accurate. E. C. C. B.

1924. *Wave-lengths of the Silicon Lines* λ4128 *and* λ4131 *and of the Carbon Line* λ4267. **J. Hartmann.** (Astrophys. Journ. 18. pp. 65–66, July, 1903.)—These three lines occur in the spectra of stars of the first type, and therefore their accurate wave-length is a matter of some importance. The author has determined these constants in reference to Kayser's standards, and finds them to be respectively $\lambda = 4128{\cdot}204$, $\lambda = 4131{\cdot}040$, and $\lambda = 4267{\cdot}301$. A vacuum tube filled at low pressure with silicon tetrafluoride in the first case and cyanogen in the second case was used as source. E. C. C. B.

1925. *Prolongation of Spectral Lines.* **T. Lyman.** (Amer. Acad., Proc. 39. 2. pp. 33–35, July, 1903.)—The prolongation of the spectrum lines with a concave grating are to a great extent due to diffraction effects. A circular image 0·01 cm. in diam. was substituted for the slit, and photographs were taken of the directly reflected image; it was found that the image was accompanied by two sharp streamers, one vertical and the other horizontal. If the ruled surface of the grating is protected by a screen having a rectangular aperture whose diagonal is less than the breadth of the ruled surface, it is then found that the orientation of this screen materially alters the diffraction effect. If the screen is so placed that the aperture is at an angle of 45° with the rulings on the grating, then the vertical streamer in the reflected image is also rotated through 45° and a new streamer at right angles to this makes its appearance, while the horizontal streamer appears as before. In the case of a slit as source exactly similar effects are obtained. In the case of spectral lines with the rectangular screen set at an angle of 45° to the ruling, the prolongations of the lines are broadened and turned, though the lines themselves remain straight and sharp. The definition of very faint spectrum lines may be very much improved by covering the ends of the ruled grating space with slanting pieces of blank paper, and thus converting the rectangular ruled space into a parallelogram. E. C. C. B.

1926. *Spectroscopic Examination of Volcanic Products by Bunsen's Method.* **R. Nasini** and **F. Anderlini.** (Accad. Lincei, Atti, 13. pp. 368–371, April 24, 1904.)—In the quest for helium, examination was made of the incrustations in the large fissure that opened on Mount Vesuvius in 1895. No trace of helium was found spectroscopically when the rocks were heated in the Bunsen flame or the oxyhydrogen flame or in a spark discharge. No great stress is to be laid on this negative result, as the author finds that a similar result is obtained when the usual helium minerals are examined by Bunsen's method, and he thus confirms the current view that the characteristic spectra of gases cannot appear with flames in the ordinary condition. Ammonia gas gives a spectrum both with the flame and with the Geissler tube, but the spectra are quite distinct, consisting of numerous bands in the former case and of sharp lines in the latter. D. H. J.

1927. *Causes of Variability of Spark Spectra.* **A. S. King.** (Astrophys. Journ. 19. pp. 225–238, May, 1904.)—The author has investigated the changes given by introducing self-induction in the circuit and also by varying capacity. He considers that the effects produced are due to changes in temperature, density of the metallic vapour, and electrical conditions. The metals studied were cadmium, zinc, magnesium, calcium, mercury, and aluminium. He finds that the lines may be divided into two groups, the first of which contains the series lines with a few others, and the second contains the lines for which no series are known. The first group of lines appears to be dependent on the rate of vaporisation of the metal rather than upon changed electrical conditions, and the vibrations which produce them are probably of a simple kind. They are reduced by self-induction and enhanced by capacity. The second group of lines is also weakened by self-induction and enhanced by capacity, but to a much greater extent than the lines of the first group. The vibrations giving these lines are probably more complex and require a stimulus other than mere vaporisation, as many of them do not appear in the arc. The following conclusions are also drawn: Self-induction and capacity have an opposite effect upon all lines; of the two subordinate series the first is much the more sensitive to all changes. The weakening of the series lines is not in proportion to their strength, but the last members of a series are reduced by self-induction much more than the first members, and a shift of the maximum intensity towards greater wave-length is produced. The effect of capacity upon series lines is to shift the maximum intensity toward the shorter wave-lengths, giving the greatest enhancement to the last numbers of a series. [See also Abstracts Nos. 1021 and 1346 (1904).] E. C. C. B.

1928. *Emission Spectra of Aromatic Compounds.* **E. Goldstein.** (Deutsch. Phys. Gesell., Verh. 6. 10. pp. 185–190, May 30, 1904.)—The author gives a further list of *single*-ring aromatic compounds which when exposed in the solid state to the action of kathode rays give discontinuous emission spectra. The list of substances studied includes: (1) Hydrocarbons, viz., xylene (ortho, meta, and para), ethyl benzene, propyl benzene, mesitylene, cumene, pseudocumene, cymene; (2) halogen derivatives of hydrocarbons, viz., chlortoluene (o., m., and p.), bromtoluene (o. and p.), chlorbenzene; (3) acids, viz., methyl benzoic acid (o., m., and p.), propyl benzoic acid, phenyl acetic acid; (4) an acid chloride, viz., benzoyl chloride; (5) alcohols, viz., benzyl alcohol, saligenin, cinnamyl alcohol; (6) an aldehyde, viz., benzaldehyde; (7) phenols, viz., xylenol (o., m., and p.), cresol (o. and p.); (8) nitriles, viz., benzonitrile, toluonitrile (o., m., and p.); (9) ketones, viz., acetophenone, methyl benzyl ketone, ethyl phenyl ketone. The position isomers in the above list give spectra of the same type. [See also Abstract No. 1644 (1904).] D. H. J.

1929. *Some Spectroscopic Notes.* **R. A. Houstoun.** (Phil. Mag. 7. pp. 456–467, May, 1904.)—In a previous paper [see Abstract No. 1842 (1904)] certain measurements were given of the satellites of the green mercury line. In the present paper the author describes some experiments on the effect of varying the conditions in the source, with the interesting result that the number and position of the satellites can be made to change. Observations were also made upon the satellites of the lines of some other metals. In the latter portion of the paper the formulæ for the echelon grating are developed for the condition (usually realised in practice) that the incident light is not normal. E. C. C. B.

1930. *Fluorescence of Crystals under Röntgen Rays.* **R. J. Strutt.** (Phil. Mag. 6. pp. 250–251, Aug., 1903.)—Röntgen rays from a focus tube were allowed to fall normally on the prism faces of crystals of magnesium platinocyanide, but the fluorescence was not found to depend on the angle between the optic axis of the crystal and the kathode stream in the tube. Thus the experiment tells against the polarisation of the Röntgen rays, for the crystals of the salt used light up with a different colour according as the plane of polarisation of the incident light is perpendicular to the optic axis or parallel to it. J. J. S.

1931. *Comparison between Spectrophotometric Measurements.* **P. Vaillant.** (Comptes Rendus, 138. pp. 1088–1090, May 2, 1904.)—The comparison between spectrophotometric measurements does not depend upon a definite value of λ, but upon a certain length of spectrum which has a minimum value, in instruments of the Gouy type, of about 2 to 3 $\mu\mu$. The author investigates how the coefficient of absorption measured depends upon the circumstances of experiment. Supposing $2\Delta\lambda$ to be the breadth of the spectral region concerned in the observation, then the absorption coefficient for a wavelength λ will be given by the relation—

$$a\lambda = \frac{1}{nl}\left(\log \int_{\lambda-\Delta\lambda}^{\lambda+\Delta\lambda} \mathrm{I}\,d\lambda - \log \int_{\lambda-\Delta\lambda}^{\lambda+\Delta\lambda} i\,d\lambda\right),$$

where l is the thickness of liquid traversed, n the concentration of the solution of the absorbing substance, and $\int \mathrm{I}\,d\lambda$ and $\int i\,d\lambda$ the amount of light before and after passage through the solution. It is evident from this that with constant concentration $a\lambda$ diminishes with increase in l, and with constant thickness of solution it increases with dilution. This coefficient $a\lambda$ depends upon the distribution of intensity I in the spectrum of the source; if this distribution varies in the same sense as the absorption of the coloured substance dealt with, then $a\lambda$ increases; $a\lambda$ decreases if the distribution of intensity varies in the opposite sense. These variations are evidently greater the more rapid the change in the absorption of the substance in the internal $2\Delta\lambda$, and, with the same rate of change in the absorption, the greater the interval $2\Delta\lambda$. Taking the example of paranitrophenol whose coefficient of absorption doubles itself between $\lambda = 520\,\mu\mu$ and $\lambda = 510\,\mu\mu$, and, further, using in turn an arc lamp as source, for which I is constant over this range, and a gas lamp for which I falls from 2 to 1, we obtain the following values of $a\lambda$ (for $\lambda = 515\,\mu\mu$) :—

	$2\Delta\lambda =$	$2\,\mu\mu$.	$5\,\mu\mu$.	$10\,\mu\mu$.
Arc	$nl = 0{\cdot}002$	596·3	577·8	518·6
	$nl = 0{\cdot}0002$.........	599·6	597·9	590·8
Gas	$nl = 0{\cdot}002$	592·4	555·5	451·4
	$nl = 0{\cdot}0002$.........	595·6	572·9	493·5

Thus considerable differences can be obtained; these differences increase with $\Delta\lambda$ and may be looked upon as negligible when $\Delta\lambda$ is $2\,\mu\mu$, but are more than 20 per cent when $\Delta\lambda$ is $10\,\mu\mu$. E. C. C. B.

1932. *Fluorescence of Naphthalic Anhydride and some of its Derivatives.* **L. Francesconi** and **G. Bargellini.** (Gazzetta Chim. Ital. 33. No. II., pp. 129–133, 1903.)—The modifications made by Hewitt [see Abstract No. 1187 (1903)] in his theory of fluorescence do not bring this into accord with the facts that naphthalic anhydride fluoresces whilst phthalic anhydride does not. According to R. Meyer's theory, the latter anhydride contains no fluorophore ring, but both naphthalic anhydride and naphthalimide contain the pyrone ring, which, according to this author, is one of the fluorophore groupings. The manner in which the members of the fluorophore ring are combined is apparently without influence on the fluorescence. Thus acenaphtheneimine exhibits fluorescence, as also, in feebler degree, do the mono- and di-oximes and the monohydrazone of acenaphthenequinone. Meyer's theory may be widened in its scope. As the introduction of one of the electro-negative groups, OH, Cl, Br, I, NO_2, diminishes the fluorescence, it may possibly be assumed that electro-positive groups, such as NH_2 and NMe_2, are capable of converting simpler groups into fluorophores. Like colour, fluorescence depends on two factors: the presence of a special fluorophore group and the nature and position of substituting residues. Thus, most amino-compounds show a far more intense fluorescence than the corresponding hydroxyl derivatives. T. H. P.

1933. *Luminescence of Organic Substances at Low Temperatures.* **E. L. Nichols** and **E. Merritt.** (Phys. Rev. 18. pp. 355–365, May, and pp. 403–418, June, 1904.)—This paper gives further results of qualitative experiments on the fluorescence and phosphorescence of a large number of bodies, chiefly organic compounds of definite composition, at low temperatures. The detailed results of the experiments are given in four tables, containing lists of substances showing at − 186° C. (1) neither phosphorescence nor fluorescence; (2) phosphorescence, but no fluorescence; (3) fluorescence, but no phosphorescence; and (4) both phosphorescence and fluorescence. In some cases it is found that substances closely related chemically behave similarly in regard to luminescence, but attempts, as before, to trace a general relation between luminescence and chemical structure have not been successful. W. C. H.

1934. *Further Observations on Radiation from a Condenser.* **F. Sanford.** (Phys. Rev. 18. pp. 366–369, May, 1904.)—The wave-length of the radiation from copper is about $372\,\mu\mu$, from zinc about $377\,\mu\mu$, and from aluminium and silver about 850 $\mu\mu$. When a thin sheet of metal is used almost all the radiation comes from the edges. It is diffuse, and apparently goes off in one direction nearly or quite as well as in another. The double images found in a previous experiment [see Abstract No. 1024 (1904)] are proved to be due to this concentration of the radiation at the edges. J. E.-M.

1935. *Production of Helium from Radium.* **W. Ramsay** and **F. Soddy.** (Roy. Soc., Proc. 72. pp. 204–207, Aug. 15, 1903.)—The maximum amount of the emanation obtained from 50 m.gm. of radium bromide was conveyed by means of oxygen into a U-tube cooled in liquid air, and the oxygen was then extracted by the pump. It was then washed out with a little fresh oxygen, which was again pumped off. The vacuum tube sealed on to the U-tube, after removing the liquid air showed no trace of helium. The spectrum was apparently a new one, probably that of the emanation. After standing four days the helium spectrum appeared, and the characteristic lines were observed identical in position with those of a helium tube thrown into the field of vision at the same time. On the fifth day the yellow, the green, the two blues, and the violet were seen, and in addition the three new lines also present in the helium obtained from radium. A confirmatory experiment gave identical results. [See also Abstract No. 1531 (1904).]

J. J. S.

1936. *Radio-activity of Metals.* **J. C. McLennan** and **E. F. Burton.** (Phys. Zeitschr. 4. pp. 553–556, July 15, 1903. Paper read before the Royal Society of Canada, May 18, 1903. Translated from the English.)—If a cylinder of any metal is enclosed within another of the same material which is insulated from it and is surrounded by air or other gas it gradually receives a negative charge, and after a short time attains a state of equilibrium in which its potential has a definite value below that of the outer cylinder. The metals used by the authors were aluminium, zinc, lead, tin, copper. They conclude from their experiments that the gas between two cylinders contains always a number of ions, and on account of the more rapid diffusion of the negative ions it is possible that an excess of these reach the inner cylinder in a given time and give to it a negative charge. According to this hypothesis the final potential must be the same for all metals. It appears more probable that at the surface of the metal a process goes on through which a surplus of positively charged particles may be continually sent out; the constant end condition would then represent a condition of equilibrium such that the current between the cylinders would be equivalent to the rate of emission of the positive charges. J. J. S.

1937. *Nervous Oscillations and their Propagation Studied by the* N-*rays Emitted by the Nerve.* **A. Charpentier.** (Comptes Rendus, 138. pp. 1121–1123, May 2, and pp. 1163–1164, May 9, 1904.)—The author in the first paper considers it possible that the augmentation of the phosphorescence observed when *n*-rays are transmitted along a wire from a nerve may instead of being continuous be made up of a series of periodic impulses too frequent for their visual detection. Taking two wires of equal length, joined to the same phosphorescent screen and connected at the other end to different parts of the excited sciatic nerve of a frog, the augmented phosphorescence is seen not to be constant, and for certain distances apart on the nerve *no* augmentation is observed although either wire singly produces the effect. This would be explained if the two series of oscillations arrived at the screen opposite in phase; and it is found that a distance of 16 mm. apart on the nerve will produce this zero effect, exactly ½ wave-length of the oscillations of a nerve ($\lambda = 35$ to 36 mm.), found by the author in former experiments. This is held to confirm the existence of these oscillations. In the second paper it is shown that to produce interference the wires need not be a specified distance apart on the nerve, as it can be produced by putting the wires any distance apart, *so long as* the distance from the point of excitation to that of application to the wire is the same in both cases, one wire being above and one below the excited point. This is considered to prove that the oscillations are longitudinal ones. L. H. W.

1938. *Study of the Spinal Cord by Means of* N-*rays.* **A. Broca** and **A. Zimmern.** (Comptes Rendus, 138. pp. 1239–1241, May 16, 1904.)—The emission of *n*-rays from the spinal cord below the seventh cervical vertebra is most marked at the following points: 2nd dorsal, 5th dorsal, 11th dorsal, 2nd lumbar, and at the middle of the sacrum. The first maximum point probably corresponds to the cilio-spinal centre, that of the 2nd lumbar vertebra to the genito-spinal and vesico-spinal centres. This maximum point was found to be well marked in a woman who had recently undergone hysterectomy, but whose ovaries were intact. In a woman, however, upon whom ovariotomy had been performed ten years previously, there was complete suppression of the emission of *n*-rays from this level except when the vesico-spinal centre was receiving stimuli. H. W. P. Y.

1939. *Relation between Organs of Perception and the Physical Agents acting upon them.* **A. Charpentier.** (Comptes Rendus, 138. pp. 1282–1283, May 24, 1904.)—From his previous experiments on the action of *n*-rays the author has been led to inquire whether there is a specific reinforcement when there is placed near a sensorial organ or the corresponding nervous centres the physical excitant capable of acting upon them. He finds, for instance, that when a phosphorescent screen is made having for base an odoriferous substance, the luminosity of this screen is increased opposite the nervous centres, especially near certain of them which may be called olfactory points. Similar effects occur in the case of the organs of vision and the related nervous centres when a screen with a luminous base is used. It is inferred from the experiments: (1) that the sensorial nervous centres are specifically different; (2) that there is a certain adaptation not only between physical agents and the sensorial agents destined to receive them, but between these agents and the nervous centres which perceive them after reception by the sensorial agent; (3) that there are certain common properties implying analogy of nature, between sensorial excitants and the peripheral or central nervous organs destined for their perception, since they show by the sort of specific resonance referred to, analogous emissive properties. [See also Abstract No. 1675 (1904).] J. J. S.

1940. *Physiological Action of the Emanation from Radium.* **C. Bouchard, P. Curie** and **V. Balthazard.** (Comptes Rendus, 138. pp. 1384–1387, June 6, 1904.)—The authors have, since February, studied the action of the radium emanation on mice and guinea-pigs. The method employed consisted in enclosing the animals in a glass vessel and causing them to breathe air charged with the emanation, the air itself being automatically regenerated without loss of the emanation itself. Controls were placed in identical vessels, but without being subjected to the emanation. At the end of an hour or longer, according to the strength of the emanation, respiratory trouble appeared, showing itself in jerky inspirations, short expirations and prolonged intermediate pauses. The animals rolled themselves up and fell into a state of torpor, the frequency of the respiratory movements diminished, and in the hour preceding death fell to 10, 8, or even 6 per min. No paralysis occurred, though sometimes a contraction of the members and convulsions. The time taken for death to ensue varied from 9 hours down to 4 hours with from 15 to 50 gm.-hours of the emanation (1 gm.-hour = unit of emanation, corresponding to the quantity disengaged by 1 gm. of radium bromide in 1 hour) in the case of mice; from 9 to 7 hours with from 15 to 20 gm.-hours in the case of guinea-pigs. The controls survived in all cases. In case any effect was caused by the slight amount of ozone present, due to the regenerating arrangements, experiments proved that twenty times the quantity of ozone present only caused death in the case of mice, in 24 hours. The chief points observable post-mortem were: Intense pulmonary congestion, with dilatation of the vessels and capillaries; the blood suffered a loss of leucocytes; rigor mortis sets in immediately on death taking place. The tissues of animals killed in this way were radio-active, and experiments were instituted to test which were the most highly so. The radiographic action is caused by the reduced radio-activity and by the presence of dissolved emanation in the humours; these are to be separated. No noxious effects were observed when the emanations were injected with other gases into the peritoneal cavity of guinea-pigs or rabbits. [At the end of these experiments, London's results were published. See Abstract No. 1967 (1904).] L. H. W.

1941. *Photographic Method for Studying the Action of* N-*rays on Phosphorescence.* **E. Rothé.** (Comptes Rendus, 138. pp. 1589–1591, June 20, 1904.)—The author describes a photographic method which he has devised to do away with the uncertainty of visual observations of the *n*-ray effects. In this, use is made of the decrease of phosphorescence of the calcium sulphide itself, photographic exposures being made for a definite time at definite intervals, first without any extraneous influence and then with the *n*-rays acting. The first series of developed images gives a series with regularly decreasing diameters, and the effect of the *n*-rays in the second series, though very slight, is considered to show that the phosphorescence is increased by the rays, and that the *n*-rays also have the effect of diminishing the rate at which the phosphorescence falls off. L. H. W.

1942. *Method for Determining Intensity of the* β*-rays, and Measurements of their Absorption.* **W. Seitz.** (Phys. Zeitschr. 5. pp. 395–397, July 15, 1904. Physikal. Institut, Würzburg.)—The author uses, in contra-distinction to Wien, Strutt, and Paschen, the negative charging of an insulated plate exposed to the β-rays as a measure of the intensity of the radiation from a radium salt, and he considers it well adapted for absorption measurements since the radium need not itself be placed in the exhausted vessel. The arrangement used consisted of a glass vessel with brass base provided with an aluminium window of 1 sq. cm. area. Inside the vessel a brass plate was suspended having a rod and a platinum bowl attached, into which latter dipped a brush of very fine spring wire, the brush being fastened to an iron rod which could be drawn up by the action of a solenoid outside the vessel, so as to break the contact with the bowl. The vessel was exhausted to the highest limit, and the insulation of the brass plate proved to be excellent. 7 mgm. of radium bromide in a lead box with a mica window was placed about 7 mm. from the Al. window, and the circuit being broken for a definite time, the charge acquired by the plate was measured by the first throw of the electrometer, previously standardised by a Harms' condenser. A number of measurements were made by this method. The absorption by tin-foil of varying thickness showed that the absorption coefficient diminished with increasing thickness. The observations of Paschen led the author also to examine if measurable charges could pass through thick sheets of lead, an indication of a negative charge being obtained through 3 mm. of lead after exposure to the radiation for an hour. From these measurements the amount of the β-rays of highest velocity which passed through the lead was about 0·291 per cent. of the total radiation, which confirms Paschen's result, although considerably smaller than the figure obtained by the latter (Paschen had 0·5 mm. of glass which enclosed the radium and probably absorbed most of the easily-absorbed radiation). The absorption of a number of other substances was determined by comparing the number of thicknesses of tin-foil which allowed an equal amount of the radiation to pass through as the substance tested, and a table showing the relation of the masses to surface for equal absorption is given, with tin as unity. The results agree to a first approximation with Lenard's law for the absorption of kathode rays, and, in the case of the elements examined, the absorption on this basis is the greater the greater the atomic weight. Finally, the absolute value of the quantity of electricity, which was caught by the plate was $0{\cdot}507 \times 10^{-12}$ coulomb per sec., so that the radium itself probably gave continuously $3{\cdot}57 \times 10^{-12}$ amp. in the form of β-radiation. This is of the same order as Wien's value (4 mgm. of radium bromide, $3{\cdot}018 \times 10^{-12}$ amp.). L. H. W.

1943. *Resonance Method for Determining the Frequency of Nervous Oscillations.* **A. Charpentier.** (Comptes Rendus, 138. pp. 1723–1725, June 27, 1904.)—The author describes experiments which show that if there are two sources of sound of the same frequency, these will reinforce each other's effects on a phosphorescent screen, and he applies this resonance method to the determination of the frequency of nervous oscillations. Using a mandoline string on a board 50 cm. long as a source of sound of adjustable frequency, joined by a copper wire to an isolated frog's nerve, the effect of the sound on a phosphorescent screen was noted while the frequency of the sound was varied. On resonance occurring, when the sound was of the same frequency as that of the nerve, a marked increase of brightness in the screen was noticeable, the method indicating figures for such nerves of 800 to 860 per sec.; the accuracy obtainable is discussed. The frequency of the nerve oscillations in living human beings was determined in a similar manner and gave values within the above limits and varying very little from day to day in healthy subjects. L. H. W.

REFERENCES.

1944. *The Strobo-stereoscope.* **G. Jäger.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 985–993, July, 1903. From the Inst. für theoretische Physik der k. k. Universität, Wien.)—A description of a stereoscopic instrument to which the stroboscopic principle is adapted. Investigations are made with it upon the position of the axis of vision of a number of observers. J. W. P.

1945. *Universal Stereoscope.* **A. Schell.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 949–973, July, 1903.)—A full account of the geometrical optics, construction and use of a stereoscope adjustable to all kinds of eyesight. G. E. A.

1946. *Improvements in Astronomical Instruments.* **R. Etzold.** (Zeitschr. Instrumentenk., Beib. 6. pp. 53–55, March 15; 7. pp. 61–64, April 1; and 10. pp. 93–97, May 15, 1904.)—A general consideration of some new types of German astronomical instruments, in which their desirable features are pointed out and the advantages discussed.

1947. *Applications of the Diastoloscope to the Study of Displacements of Luminous Objects.* **C. Chabrié.** (Comptes Rendus, 138. pp. 799–802, March 28, 1904.)—The displacements of luminous lines and points are considered mathematically, and applications to the measurement of the speeds of stars and the determination of the passage of stars through specified points are suggested. J. W. P.

1948. *Zöllner's Photometer.* **H. Clemens.** (Zeitschr. Instrumentenk. 24. pp. 129–131, May, 1904.)—A description of the instrument. J. W. P.

1949. *New Interferometer Method for Refractive Indices.* **E. R. v. Nardroff.** (Science, 17. p. 861, May 29, 1903. Paper read before the New York Academy of Sciences (Astronomy Section), May 4, 1903.)—The plate to be tested is interposed in one of the beams of a Michelson interferometer at an angle of 45°, and the refractive index is calculated from the number of bands passing a fixed point on rotating the plate through 45° to the perpendicular position. G. E. A.

1950. *Optical Constants of a System of Lenses.* **A. Schell.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 1057–1090, July, 1903.)—A mathematical consideration and description of focometer for exact measurement of the optical constants. J. W. P.

1951. *Double Refraction in the Magnetic Field.* **A. Schmauss.** (Ann. d. Physik, 12. 1. pp. 186–195, July 21, 1903. Phys. Inst. d. Universität, München.)—Crossed nicols are used to observe the action of the field on the light from an electric glow lamp. The general conclusion is that the double refraction observed by Majorana is due to the action of the field upon the suspended particles in colloidal iron solutions. J. W. P.

1952. *Non-homocentric Pencils and the Shadows Produced by them.* **W. Bennett.** (Phil. Mag. 7. pp. 700–715, June, 1904. Communicated by the Physical Society, Jan. 22, 1904.)—This is an elementary treatment (1) of the standard astigmatic pencil, *i.e.*, one of which all the rays pass through two focal lines at right angles to one another and to the axis of the pencil, (2) of the shadows produced by axially symmetric pencils possessing spherical aberration. Experimental methods of observing the forms are described. J. W. P.

1953. *Variation of Photo-electric Sensibility.* **E. v. Schweidler.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 974–984, July, 1903. II. physikal. Institut der k. k. Univ. in Wien.)—The light-sensitive substances Zn, amalgamated Zn, Mg, and magnalium were tested, and the fatigue observed by Kreusler [see Abstract No. 65 (1902)] is found to be caused chiefly by "effective" light, *i.e.*, ultra-violet. The sensibility as regards fatigue and recovery is greater for long waves than for short waves, the fatigue being the same for positive as for negative charges. Recovery takes place in the light as well as in the dark, and the fatiguing and recovery may go on simultaneously. Recovery is most vigorous with fresh surfaces, and some methods of treating the surface produce a permanent reduction of the sensibility. G. E. A.

1954. *A Two-coloured Substance.* **A. Pflüger.** (Phys. Zeitschr. 4. pp. 520–521, July 1, 1903.)—The above is obtained by dissolving a pinch of cyanin and one of nitrosodimethylanilin in about 20 c.cm. of alcohol. When pure alcohol is poured on this solution to form a layer, the intermediate layer exhibits a green colour, whilst the lower portion is red. Other ways of demonstrating this property are mentioned. G. E. A.

1955. *Anomalous Dispersion and Selective Absorption of Fuchsine.* **W. B. Cartmel.** (Phil. Mag. 6. pp. 213–227, Aug., 1903. Paper read before the Washington meeting of the Amer. Assoc. for Advancement of Science.)—The dispersion and selective absorption of fuchsine were measured by interference methods, an interferometer somewhat after the Michelson type being used. A complete description of experimental details and curves of the results are given. E. C. C. B.

1956. *Magnetic Rotation of Quartz.* **A. Borel.** (Archives des Sciences, 16. pp. 24–49, July, and pp. 157–171, Aug., 1903.)—In these papers tables are given of the values of Verdet's constant calculated from experiment. The values given refer to seven Cd lines and the D line for temperatures of 96° and about 20°. The constants are corrected for successive reflections within the quartz. G. E. A.

1957. *Separation of Spectral Rays very close to one another.* **O. Lummer** and **E. Gehrcke.** (Journ. de Physique, 3. pp. 345–350, May, 1904.)—In replying to the criticisms of Perot and Fabry [see Abstract No. 781 (1904)], the authors point out that Perot and Fabry seem to have overlooked the advantage of greater visibility possessed by their method, and give reasons from their experimental knowledge for their belief in the complexity of certain spectral rays; for example, on rotating the plane-parallel plate in its own plane, the distinctness of the interference phenomena varies without altering in character. G. E. A.

1958. *Effect of Pressure on Phosphorescent Sulphides.* **P. Waentig.** (Zeitschr. Phys. Chem. 44. pp. 499–500, July 17, 1903. Phys. chem. Institut, Leipzig.)—Phosphorescent sulphides, prepared according to the directions of Klatt and Lenard, lose nearly all their luminous properties when finely powdered in a mortar. At the same time they assume a colour which seems to be complementary to their former phosphorescent light. G. E. A.

1959. *Supposed Radio-activity of Retene.* **E. v. Schweidler.** (Phys. Zeitschr. 4. pp. 521–522, July 1, 1903. II. physikal. Institut d. Univ. Wien, June, 1903.)—Retene $C_{18}H_{18}$, said by Arnold (Wied. Ann., 1897) to give off Becquerel rays, was tested in the pure and commercial state for radio-activity, but with negative results. When subjected to kathode rays the freshly exposed powder gives a fluorescent blue light, changing to red-violet. With a better vacuum and greater primary e.m.f. the colour changes very rapidly through blue, red-violet, salmon-pink, to whitish-blue. G. E. A.

1960. *Polonium.* **F. Giesel.** (Chem. News, 88. p. 61, Aug. 7, 1903. From Ber. Deutsch. Chem. Gesell. 36. p. 2368, 1903.)—An account of experiments which show that it is easily possible to impart to bismuth or the platinum metals, by momentary contact with radium, properties which exactly resemble those exhibited by polonium. J. J. S.

1961. *The γ-rays of Radium.* **R. J. Strutt.** (Roy. Soc., Proc. 72. pp. 208–210, Aug. 15, 1903.)—Measurements of the rate of leak produced in various gases by the γ-rays from radium are given, and a table of the relative ionisations produced by the three varieties of radium rays and by Röntgen rays. The values of these latter for the γ-rays are about the same as those for the β-rays. J. J. S.

1962. *Emanation from Phosphorus.* **C. Barus.** (Ann. d. Physik, 11. 5. pp. 1142–1144, July 7, 1903.)—The author comments on Schmidt's theory of the phosphorus emanation. He explains the charge of the phosphorus particles as the outcome of a mass action. By the oxidation of the phosphorus a product is formed which with excess of phosphorus is stable, with excess of air is unstable. Whilst the oxide migrates from the phosphorus surface it divides up, and an equal number of positive and negative ions are present. Reference is made to the behaviour of nuclei in various cases. J. J. S.

1963. *Action of Radium Rays on Solution of Iodoform.* **W. B. Hardy** and **Miss E. G. Willcock.** (Roy. Soc., Proc. 72. pp. 200–204, Aug. 15, 1903.)—A fuller account of the experiments already referred to in Abstract No. 298 (1904). J. J. S.

1964. *The Emanation from Radium.* **E. Rutherford.** (Nature, 68. pp. 366–367, Aug. 20, 1903.)—Calculations are given of the probable amount of emanation and of helium produced by radium on the disintegration hypothesis. The determination of the mass of the α body, taken in conjunction with the experiments on the production of helium by the emanation, supports the view that the α particle is in reality helium. J. J. S.

1965. *Action of N-rays on Biological Phenomena.* **M. Lambert** and **E. Meyer.** (Comptes Rendus, 138. pp. 1284–1285, May 24, 1904.)—Experiments are described which lead the authors to conclude that *n*-rays exercise an inhibitory influence on soluble ferments, as they do on vegetation, but that this influence is extremely feeble. H. W. P. Y.

1966. *Action of Anæsthetics on the Sources of* N_1*-rays.* **J. Meyer.** (Comptes Rendus, 138. pp. 1335–1337, May 30, 1904.)—Experiments are described which show that the emission of N_1-rays from a given source ceases in the presence of chloroform or ether vapour. [See also Abstract No. 1658 (1904).] H. W. P. Y.

1967. *Physiological and Pathological Value of the Radium Emanation.* **E. S. London.** (Archives d'Él. Médicale, 12. pp. 363–372, May 25, 1904. Communication to the Biological Section of the Society of Public Health, St. Petersburg, March 15, 1904.)—The author describes the effects of the emanation from radium on the human skin, on frogs, and on white mice. On the frogs the effects observed were similar to those obtained by Bouchard, Curie, and Balthazard on guinea-pigs [see Abstract No. 1940 (1904)], though the frogs survived longer than the latter. The effects on blood and on ferments are described, and the disinfecting action of the emanation was tested by inserting sterilised gelatine into two Erlenmayer flasks, one of which had been in communication with a radio-active source for two days and was then left for three weeks till the emanation had disappeared. In the control flask an enormous number of colonies of bacteria developed, whilst in the flask which had been filled with the emanation not a single one appeared.

L. H. W.

1968. *Emission of N-rays after Death.* **A. Charpentier.** (Comptes Rendus, 138. pp. 1351–1352, May 30, 1904.)—The dried bodies of frogs which have been killed by curari are found to emit a variable quantity of *n*-rays, especially from the region of the nervous centres. The emission is increased by applying the faradic current to the central end of the sciatic nerve. It gradually decreases, but at the end of two months a certain amount is still perceptible from the brain. H. W. P. Y.

1969. *Present State of the N-ray Question.* **H. Guilleminot.** (Archives d'Él. Médicale, 12. pp. 373–382, May 25, and pp. 407–410, June 10, 1904.)—A useful general summary of recent results, with references to original papers.

HEAT.

1970. *Heat of Fusion of Ice.* **A. W. Smith.** (Phys. Rev. 16. pp. 383–384, June, 1903. Abstract of paper read before the Amer. Physical Society, April 25, 1903.)—In the determination of this constant the ice in small pieces was previously cooled several degrees below 0° C., and after weighing was transferred to the calorimeter containing kerosene oil already cooled to the same temperature. Heat was supplied by means of an electric current, the amount of heat being calculated by measuring both the current through the coil in the calorimeter, and the e.m.f. between its terminals, in terms of a standard-cell. The preliminary value given for the constant is 334·25 joules as the mean of eight determinations of the heat of fusion of ice, in each of which about 100 gm. of ice was melted. J. J. S.

1971. *Gas Densities at High Temperatures.* **F. Emich.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 931–948, July, 1903. Laborat. f. allgem. Chemie an der k. k. techn. Hochschule in Graz.)—The method due to Bunsen, in which the rate of flow of a gas through a small opening is observed, is used, but with a number of modifications. The rate of efflux is measured by the help of a Morse instrument. On the ribbon, time reference marks are recorded by the use of a pendulum swinging through a drop of mercury. Electrical circuits were completed by the pendulum, and also when a certain volume of gas was contained in the gas reservoir, and finally when a certain volume had issued from the cylinder. For any particular arrangement of the apparatus we have: (time of efflux)^2/absolute temperature = a constant. The author chiefly arranges his results so as to test whether this relation is fulfilled. The more important experiments were made with porcelain, platinum, and iridium tubes having small openings at the ends or at the middle. In the case of air it is proved that the above relation is obeyed. With carbon dioxide the influence of dissociation at the higher temperatures was noticed. The temperatures were measured by the thermopile, or in the case of the higher temperatures by the use of the "black body" method. W. W. H. G.

1972. *Specific Heats, especially at Low Temperatures.* **H. E. Schmitz.** (Roy. Soc., Proc. 72. pp. 177–193, Aug. 14, 1903.)—The specific heat of a number of metals is found by the method of mixtures. The solid substance is immersed in liquid air and then transferred to water, being well shaken before immersion in the calorimeter. The effect of the liquid air carried over into the calorimeter is investigated and found to be very small. Observations are made with thallium, lead, aluminium, iron, nickel, cobalt, zinc, silver, and tin. The ice method is also described. [See Abstract No. 810 (1904).] Determinations of the specific heat of the same metals are also made over the range 20°–100°, with a view to tracing the change in atomic heat with change in temperature. It is found that the metals of low atomic weight have the greatest change in atomic heat. For aluminium (approximately pure) the atomic heat over a range of temperature having − 85° as mean, is 4·66, and over a range having + 60° as mean it is 5·91. S. G. S.

1973. *Heat Change Produced by the Solution of Naphthalene in Various Solvents.* **C. Forch.** (Ann. d. Physik, 12. 1. pp. 211–217, July 21, 1903. Physikal. Institut d. techn. Hochschule, Darmstadt.)—The heat of solution of naphthalene in toluene, benzene, and chloroform is independent of the concentration. With carbon bisulphide there appears to be a slight increase in the heat of solution at higher concentrations, but the increase is very near to the limits of error of the observations. In these cases, then, the internal energy of the naphthalene molecules is independent of the volume they occupy. In ether, a decided increase in the heat of solution of naphthalene is observed as the concentration increases. The values (in cals.) obtained for the heat of solution were: In carbon bisulphide, — 35·04 ± 0·18; in toluene, — 32·60 ± 0·27; in benzene, — 32·26 ± 0·07; in chloroform, — 27·04 ± 0·16; in ether, 28·07 (at 1·63 per cent.), and 29·26 (at 8·44 per cent.). The mean of the values obtained by various investigators for the latent heat of fusion of naphthalene is 35·6 cals., a number agreeing well with its heat of solution in carbon bisulphide. [See also Abstract No. 1693 (1904).]

T. H. P.

1974. *Capillary Constants and Specific Densities for Salts at their Melting-points.* **S. Motylewski.** (Zeitschr. Anorg. Chem. 38. 4. pp. 410–418, Feb. 17, 1904. Techn. Hochschule, Charlottenburg.)—The author continues some of Traube's work (Ber. Deut. Chem. Gesell. 24. pp. 1853, 1891), using the same drop method. Apparatus is standardised by use of water. A few measurements with alkali salts are given, but mostly those with salts of the alkaline earths and heavy metals. It is found that salts of the same basicity and same class give values which vary between narrow limits, so that this method can be used to check the basicity of an acid or the molecular weight of a salt. There appear to be several anomalies which require further investigation. The determinations of the specific densities of the salts at their melting-points are made by suspending a platinum sphere in them from a balance. It is also found that the capillary ascensions of aqueous solutions can be used to determine solubilities, since it has been shown by Traube that the height varies as the number of groups (n) in the molecule, divided by 3^n for the gm.-molecule. H. H. F. H.

1975. *Melting-point of Gold.* **D. Berthelot.** (Comptes Rendus, 138. pp. 1153–1156, May 9, 1904.)—The author gives a *résumé* of former measurements of the melting-point of gold, and points out that concordant results have only been obtained since the introduction of electric heating and of porcelain gas-thermometers. The following are the results obtained by the author by measuring the change in density of air by an optical method, together with the values arrived at by Holborn and Day by means of a nitrogen thermometer constructed of platinum, and by Jacquerod and Perrot, using a thermometer of quartz. Corrections are applied to bring the measured temperatures to absolute values—taking account of the molecular attraction according to van der Waals.

Berthelot (1898).	Holborn and Day (1900).	Jacquerod and Perrot (1904).
1065·6°.	1064·3°.	1067·4°.

T. H. P.

1976. *Experiments with the "Cold-Hot Tube" in the Electric Furnace.* **R. Nasini** and **F. Anderlini.** (Accad. Lincei, Atti, 13. pp. 535–539, May 15, 1904.)—A description of attempts to effect the combination of nitrogen and oxygen by heat alone, using the "cold-hot tube" method of Deville, a mixture of air and oxygen being slowly circulated through a porcelain tube, traversed axially by a brass tube with a polished silver surface, through which cold water is passed. The central portion of the porcelain tube is jacketed by a carbon one, and is heated in the electric furnace, the escaping gases being led into alkaline water. By this process no combination is produced at temperatures up to 2,000° C., the point of fusion of the porcelain, and the authors conclude that for temperatures below this an electric spark or a process of combustion is necessary to bring about combination. The same method has also been employed with the object of determining if the absorption of argon by magnesium, stated to occur during prolonged sparking between magnesium poles, is a function of the temperature; but no appreciable absorption is found to take place when argon is passed over magnesium ribbon in the porcelain tube at temperatures up to 2,000° C.

W. H. St.

1977. *Thermodynamic Relation between the Heat of Solution and Alteration with Temperature of Solubility of Dissociated Substances.* **A. A. Noyes** and **G. V. Sammet.** (Zeitschr. Phys. Chem. 43. pp. 513–538, May 12, 1903.)—The substances used were potassium perchlorate and *o*-nitrobenzoic acid. The heat of solution at 20° was determined, and the solubility and electrical conductivity at 10°, 20°, and 30°. The calculated value for *o*-nitrobenzoic acid was 7·5 per cent. too high, and for potassium perchlorate 1·1 per cent. too high. The constants experimentally determined were as follows:—

		o-Nitrobenzoic Acid.	Potassium Perchlorate.
Mol. heat of solution (20° C.)		6,025	121·30
Solubility (millimols. per litre)	10°	26·62	78·07
" " "	15°	31·06	
" " "	20°	36·57	120·4
" " "	25°	43·19	
" " "	30°	51·60	179·9

Values are also given for the electrical constants λ_∞, a, and K. T. M. L.

1978. *New Laws of Ionometry.* **E. Wickersheimer.** (Comptes Rendus, 137. pp. 319–322, Aug. 3, 1903).—The laws are deduced from Raoult's experiments. Starting with the Clapeyron-Clausius equation, the author obtains a general equation $CL_1/\Delta L_2 = I^2/I'^2$, where C is the change of the freezing-point I, Δ of the boiling-point I′. New relations are obtained on comparing this with Raoult's equation. The author also points out that his equation is obtained directly on dividing Arrhenius' equation by van't Hoff's.

H. H. F. H.

1979. *Physical Properties of Solutions of Oxalic Acid in Presence of Neutral Salts.* **A. Fedoroff.** Jurn. Russk. Fisik. Chimičesk. Obščestva, 35. pp. 639–640, pp. 643–644, and pp. 651–652, 1903.)—In the first paper the coefficient of distribution of oxalic acid between water and ether is investigated. It is found that the concentration of the oxalic acid in the aqueous phase is increased by the addition of sodium or potassium oxalate, but diminished in presence of ammonium chloride. In the second paper are described cryoscopic measurements of (1) solutions of oxalic acid, ammonium chloride, and ammonium oxalate, containing from $\frac{1}{2}$ to $\frac{1}{32}$ of an equivalent per litre, and (2) solutions of oxalic acid mixed with those of either ammonium chloride or ammonium oxalate. The first of these salts does not affect the cryoscopic behaviour of oxalic acid, but, when the latter is present, depressions less than the normal are obtained. This the author considers to be due to the formation of acid or complex salts. The third paper gives an account of electrical conductivity measurements, by the Kohlrausch-Ostwald method, of a solution of oxalic acid containing either ammonium chloride or oxalate, show that the former of these salts diminishes the conductivity, whilst the latter increases it. T. H. P.

1980. *Formation of Mixed Crystals of Mercuric Chloride and Iodide.* **M. Padoa** and **C. Tibaldi.** (Accad. Lincei, Atti, 12. pp. 158–166, Aug. 16, 1903.)—The freezing-point curve of mixtures of mercuric chloride and iodide consists of two branches meeting in a cryohydric point at about 145°, which is 109° below the melting-point of the pure iodide and 132° below that of the chloride; the form of the curve points to the formation of a discontinuous series of mixed crystals and excludes the existence of chloriodide. A series of analyses was made to determine the composition of the mixed crystals which separated from liquid mixtures of different concentrations, with a view to determine the limiting concentrations of the constituents in the mixed crystals. The following are the results:—

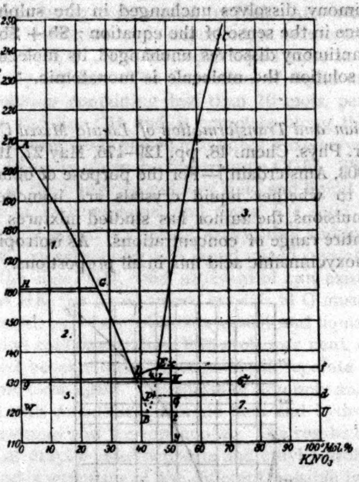
Percentage Composition of the Liquid Mixture in Molecules of Mercuric Chloride.	Composition of the Crystals.
85·7	92·2
69·4	79·6
60·4	72·3
41·4	47·6
24·3	22·1

A graphic study of these results shows that the cryohydrate must consist of a mixture of two species of mixed crystals containing (about) 50 and 70 per cent. (in molecules) of mercuric chloride respectively. All the yellow crystals which separated from the liquid mixtures were found to change quickly at the ordinary temperature to a red colour—even when the crystals contained only 1·8 molecules of iodide per cent. The change is ascribed by the authors to the decomposition of the mixed crystals into red crystals rich in iodide and crystals of pure mercuric chloride. The authors draw attention to the crystallographic isomorphism of the chloride, bromide, iodide, and oxide of mercury. D. H. J.

1981. *Theory of Critical State.* **J. Traube.** (Zeitschr. Anorg. Chem. 38. 4. pp. 399–409, Feb. 17, 1904. Techn. Hochschule, Charlottenburg.)—The author considers Young's and Teichner's latest work in connection with his own. He obtains a constancy of temperature of 1/100° in his measurements with carbon tetrachloride. It was found that a distinct mist could be seen when 0·6° above the critical temperature, and 30 min. after the meniscus had vanished. This is clearly not due to an admixture of air or other foreign substance, and a special experiment with ether proves that admixture decreases the mist. It is found that the mode of heating, in a paraffin or a vapour bath, effects the determination of the critical temperature, as much as 1·3° difference being obtained. In an unpublished determination of

Young's the critical density is found to depend on the position in the tube where the meniscus vanishes. In support of his theory of the existence of fluid and gaseous molecules, the relation between $bd(pv)/dp$ and the molecular refraction is considered. [See Abstract No. 208 (1904).] H. H. F. H.

1982. *Solidification and Transformations of Mixtures of Silver Nitrate and Potassium Nitrate.* **A. Ussow.** (Zeitschr. Anorg. Chem. 38. 4. pp. 419–428, Feb. 17, 1904.)—The author has investigated the complete freezing-point curve for mixtures of silver nitrate and potassium nitrate. His results are best seen from the accompanying Fig. AD is the freezing-point curve with silver nitrate as solid phase, HG being the transition temperature of silver nitrate in presence of potassium nitrate. This is the same as for pure silver nitrate, showing that no mixed crystals are formed. CE is the freezing-point curve with potassium nitrate as solid phase. DE is the freezing-point curve with double-salt $AgNO_3 . KNO_3$ as solid phase. This cannot be followed to the melting-point of the compound, so that the latter is stable only in contact with solutions containing excess of silver nitrate. If surfusion is allowed to occur, the metastable curves DB and EB can be realised, B being then an eutectic point. *p* represents the transition-point of potassium nitrate, which is also independent of the presence of silver nitrate, showing also the non-formation of mixed crystals. The different regions of the diagram are for the following bivariant systems (A_1 and A_2 represent the two modifications of silver nitrate, K_1 and K_2 those of potassium nitrate, D represents double-salt) :—

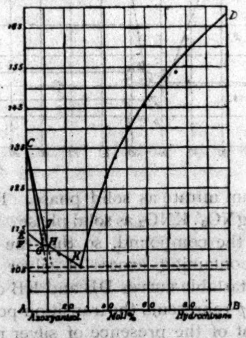


1. A_1
2. A_2
3. K_1
4. D
5. D + A_2
6. D + K_1
7. D + K_2

When the double-salt does not form, field 4 and the boundary curve *x*K*qzy* disappear. The new metastable region 7K_2 occurs. The region 5 as far as the line DB and the region 6 now represent the metastable portions of the regions 2A_2 and 3K_1 respectively. Below WBU exist the mixtures $A_2 + K_2$. A. F.

1983. *Cryoscopic Investigation of Solutions in Antimony Sulphide.* **Guinchant and Chrétien.** (Comptes Rendus, 138. pp. 1269–1272, May 24, 1904.) —In these investigations the authors make use of an electric furnace in which the heating is carried out by nickel wire, and the temperature measured by a thermo-element, which serves also as a stirrer. By dissolving silver sulphide and lead sulphide in antimony sulphide, a mean value, $k = 790$, is obtained for the cryoscopic constant of the solvent. Calculating the latent heat of fusion from this by means of van't Hoff's formula, the value 16·7 cals. is arrived at, the experimental number being 17·5 cals. The specific heat of antimony sulphide, obtained by calorimetric measurements, has the mean value 0·0816 between 20° and 500°, 0·220 at 500° (solid), and 0·263 at 582° (liquid). By dissolving antimony in molten antimony sulphide, a depression of the freezing-point is obtained which gives no certain information as to whether the antimony dissolves unchanged in the sulphide or whether a reaction takes place in the sense of the equation : $Sb + Sb_2S_3 = Sb_3S_3$. Supposing that the antimony dissolves unchanged, its molecular weight is 113, showing that in solution the molecule is monatomic. T. H. P.

1984. *Formation and Transformation of Liquid Mixed Crystals.* **A. C. de Kock.** (Zeitschr. Phys. Chem. 48. pp. 129–176, May 27, 1904. Dissertation, sent in March, 1903, Amsterdam.)—For the purpose of obtaining further data for deciding as to whether liquid crystals are homogeneous, one-phase systems or are emulsions, the author has studied mixtures of mixed crystals throughout the entire range of concentrations. As isotropic liquids, *p*-azoxyanisol and *p*-methoxycinnamic acid mix in all proportions. On cooling down the solution, a turbidity, showing the formation of liquid crystals, makes its appearance at a temperature depending on the composition of the initial solution. In this way the author has found that the two substances mentioned are capable of forming with each other a continuous series of liquid mixed crystals ; the curve of equilibrium for mixed crystals and isotropic liquid, exhibiting a minimum point (at a composition of about 10 per cent. methoxycinnamic acid) as in the case of mercuric bromide and iodide. If the liquid mixed crystal is further cooled, solid crystals of one or other component begin to separate out. The curve of equilibrium for solid crystal—liquid crystal is of the simple two-branched type with eutectic point. The curve for the mixed crystals points to the homogeneity of the latter. A very



interesting behaviour was obtained with mixtures of *p*-azoxyanisol with hydroquinone, a substance which does not form mixed crystals. The results obtained by the author are represented graphically in the accompanying Fig. D represents the melting-point of hydroquinone, C the temperature at which *p*-azoxyanisol passes from the state of anisotropic to isotropic liquid, and E the transition-point for solid and liquid crystals. On cooling down clear solutions of *p*-azoxyanisol and hydroquinone, in which the concentration of hydroquinone is not greater than about 10 mols. per cent., a temperature is reached at which formation of mixed liquid crystals occurs. CH and CG represent the "freezing-point" (passage from clear liquid to liquid crystals) and melting-point curves respectively. With solutions containing a higher concentration of hydroquinone than is represented by H, solid azoxyanisol separates out, the temperatures at which this occurs, with varying concentration of hydroquinone, being represented by HK. At concentrations, again, greater than K, solid hydroquinone is deposited, at temperatures and concentrations represented by KD. The isotropic liquid state is, therefore, for all mixtures, bounded by CHKD. The formation of liquid mixed crystals on cooling down a solution containing less than 10 mols. per cent. of hydroquinone, begins on the line CH and is complete along the line CG. The clear liquid has then completely passed into liquid mixed crystals. The region of stability of the latter is given by the triangle CGE. The line EG represents the lowering of the transition-point of solid and liquid crystals of azoxyanisol in presence of hydroquinone, and along EG solid azoxyanisol is in equilibrium with liquid mixed crystals of azoxyanisol and hydroquinone. At G, solid azoxyanisol can exist along with liquid mixed crystals and clear liquid H. Since, below the line FGH, solid azoxyanisol can exist only in contact with clear solutions HK, the liquid mixed crystals at G must, if the temperature is further lowered, pass into solid azoxyanisol and liquid H. On cooling down a clear solution containing about 8·75 mols. per cent. of hydroquinone, the solution will first become turbid, then solid will separate out, and then the solution will become clear again. A diagram of precisely analogous character was also obtained with *p*-methoxycinnamic acid and hydroquinone, as well also as with *p*-azoxyanisol and benzophenone. The results of an incomplete study of mixtures of ethyl *p*-azoxybenzoate and ethyl *p*-azobenzoate are also communicated; and a summary of the different possible types of formation and transformation of liquid mixed crystals. On account of the opposition to the view of the homogeneity of the liquid crystals, the author has repeated experiments made by Tammann [see Abstract No. 2104 (1902)], who found that the turbid liquid did not clear sharply at one temperature, but gradually over a range of temperature. The author was unable to confirm this with his specimen of *p*-azoxyanisol, but found it with a specimen supplied by Tammann. The same behaviour could be imitated by adding an impurity, *e.g.*, benzophenone, to the azoxyanisol. Optical measurements also failed to give any support to the emulsion theory of liquid crystals, although the author still considers that the turbid appearance has not yet been sufficiently explained. The author discusses in detail what behaviour should, in accordance with the phase-rule, be found if liquid crystals are really emulsions, and shows that the calculated behaviour is at variance in several respects with that actually observed, and concludes, therefore, that the phenomena observed on cooling liquid crystals, alone or mixed with other substances, can be adequately explained only by assuming that liquid crystals are homogeneous. A. F.

round a point in d with angular velocity (p, q, r). He finds in that case for the component forces—

$$X = \frac{mm_1}{d^2} - \frac{3}{8} mm_1 A^2 (q^2 + r^2),\ Y = \frac{1}{4} mm_1 A^2 \left(pq + \frac{dr}{dt}\right),\ Z = \frac{1}{4} mm_1 A^2 \left(pr + \frac{dq}{dt}\right).$$

Here mm_1/d^2 expresses Coulomb's law, and the complementary terms are independent of d. For a particular value of $\sqrt{p^2 + q^2 + r^2}$, $X = 0$, and for that value the velocity of either charge is less than 1/A. Finally, he applies this result to the determination of the action between two charges at rest on the earth's surface as affected by the earth's motion. S. H. B.

1994. *Forces Acting on a Charged Condenser Moving through Space.* **F. T. Trouton** and **H. R. Noble.** (Roy. Soc., Proc. 72. pp. 132–133, Aug. 14, 1903, Abstract.)—If a charged condenser be placed with its plane in the direction of the ether drift, then on the assumption that a moving charge develops a magnetic field there will be associated with the condenser a magnetic field perpendicular to the lines of electric induction and to the direction of motion. Thus if we have a condenser freely suspended with its plates making an angle with the ether drift, there is a couple tending to increase this angle. By utilising the earth's motion through space this couple can be sought for. A condenser was suspended by a fine wire and charged. Observations were made at different times in the day when the plane of the condenser made various angles with the direction of the drift. The longest observed deflection, 0·36 cm., barely exceeds 5 per cent. of the calculated deflection 6·8 cm., whence it is concluded that the result is a purely negative one. It is contended that the electrostatic energy N of a charged condenser must diminish by the compensating amount $N(u/v)^2$, when moving with a velocity u at right angles to its electrostatic lines of force. [See also Abstract No. 1701 (1902).] E. H. B.

1995. *Magnetic Effects of Moving Bodies in an Electrostatic Field.* **A. Eichenwald.** (Ann. d. Physik, 13. 5. pp. 919–943, April, 1904.)—Previous experiments by this author have shown that the fictitious charge of the dielectric by its motion produced magnetic effects like those produced by a true electric convection or by an ordinary current. The present paper deals with new and more elaborate experiments undertaken to further test the question. As the result the author contends that the magnetic effect of a dielectric moved in an electrostatic field is quantitatively established with just as much certainty as the magnetic effect of a conductor in motion. [See also Abstract No. 137 (1904).] E. H. B.

1996. *Flux of Energy and Radiation in the Electromagnetic Field Generated by Electric Convection.* **G. Picciati.** (Accad. Lincei, Atti, 13. pp. 384–392, April 24, 1904.)—In this paper are first given the known general equations of the electromagnetic field due to a moving charge, the potential f being the retarded potential, and satisfying the equation $\Box f = \Delta^2 f - A^2 d^2 f/dt^2$, in which 1/A is the velocity of light in ether. The writer finds that for velocities of the moving charge very small compared with 1/A, the flux E of energy into infinite space, *i.e.*, the radiation, is $E = -(2/3) m^2 A^3 a^2$, in which a is the acceleration of the charge m. In illustration he considers the case of a charge moving in a plane taken for that of $x\,y$, parallel to which is a conducting plane on which there will be an induced distribution of electricity due to the motion of the charge. Let F denote the statical potential of the charge; U, V, the components of vector potential due to it. And let F_1, U_1, V_1, be the corresponding potentials due to the induced distribution. Also let k denote the resistance constant of the conducting planes, *i.e.*, one-thirtieth part of the resistance per unit of surface. Then he finds :—

$$\frac{k}{2\pi}\frac{dU_1}{d(z)}-\frac{dF_1}{dx}-A\frac{dU_1}{dt}=\frac{dF}{dx}+A\frac{dU}{dt}, \quad \frac{k}{2\pi}\frac{dV_1}{d(z)}-\frac{dF_1}{dy}-A\frac{dV_1}{dt}=\frac{dF}{dy}+A\frac{dV}{dt},$$

where (z) is the absolute value of z, irrespective of sign. And these equations are proved to hold at all points in space, and not only on the plane $z=0$. From these equations F_1, U_1, V_1, can be found. S. H. B.

DISCHARGE AND OSCILLATIONS.

1997. *Electrification Produced by Bubbling Air through Aqueous Solutions.* **D. Pacini.** (Accad. Lincei, Atti, 13. pp. 559–567, May 15, 1904.)—J. J. Thomson studied the electrification of drops of liquid passing through gases, with the result that the maximum anomalies were exhibited by coloured solutions; the present author therefore experimented chiefly with coloured substances in his converse study of the electrification of solutions by the passage of gases through them. In the experiments the liquid, through which purified air was slowly bubbled at constant pressure, was placed in a receiver of the form of a closed test-tube. Into the liquid dipped a platinum plate (or rather two plates which for this purpose were connected) which was attached to the terminal of a sensitive quadrant electrometer. Experiments were made with different concentrations, and in general it was found that there was a characteristic curve for each substance to express the course of the phenomenon. The bodies studied may be divided into two classes: (1) Colouring matters which do not change the sign of the electrification of the water when the concentration is increased, viz., picric acid, eosin yellow, naphthol yellow, resorcin, tartrazin, naphthol green, ponceau 3R. (2) Colouring matters which change the sign of electrification with increasing concentration, viz., rosanilin, methyl violet, fuchsin, malachite green, safranin, methylene blue. It is to be noted that the members of the first group have all acid characters; those of the second group are basic substances.

D. H. J.

1998. *Kathodic Fall of Potential of Glow Discharge in Magnetic Field.* **J. Stark.** (Ann. d. Physik, 12. 1. pp. 31–51, July 21, 1903.)—The effects of a magnetic field on the kathode rays and canal rays are described. The results follow from the electromagnetic forces due to the motion of the ions in the magnetic field. Observations of the relation between K and i [see Abstract No. 1736 (1904)] are made, with magnetic fields of varying strength and in different directions. It is found that the normal kathodic p.d., K_n, which is independent of current density, gas pressure, and temperature, is also independent of the magnetic field, whether this is longitudinal or transverse. Further, the field affects both i and f in the equation—

$$K=K_n-\frac{k}{pf^{\frac{1}{2}}}(i-H.p.f)^{\frac{1}{2}}.$$

The area of the kathode surface f which is covered by the negative glow is a function of H the magnetic field strength, decreasing with increasing field when this is transverse, but increasing with the field longitudinal. In the first case the current i is increased and the current density i/f is therefore increased. In the second case i increases more rapidly than f, so that i/f again increases, but not so rapidly for a longitudinal as for a transverse field. The effect of the distance of the glass wall of the discharge tube from the kathode is also studied, and it is found that with longitudinal field, when the glass wall is near enough to affect the negative glow, the field causes f to increase and consequently K to decrease. S. G. S.

1999. *On the Currents Generated in the "Duddell" Circuit.* **R. Manzetti.** (Atti. dell' Assoc. Elettr. Ital. 7. pp. 349–355, July–Aug., 1903.)—In order to demonstrate the existence of two currents of different periodicities, a loud-speaking telephone is placed in the shunt circuit, which reproduces with remarkable intensity all the sounds emitted in the arc. With a short arc of small current a low whistling is produced, which varies in pitch and intensity with the smallest variations of the continuous current. With a long arc and greater continuous current a much more feeble sound is heard in the telephone, but the sound has a much purer tone. This sound does not vary to any appreciable extent with variation in the arc, so long as this is stable and the variations in current and length of arc do not exceed certain limits. The author also refers to his stroboscopic method of studying the current in the arc. [See Abstract No. 1737 (1904).] He concludes that there are two oscillatory currents in the Duddell circuit, one essentially dependent on the conditions of the arc, and the other only dependent on the conditions of the circuit, both, however, being produced by the arc. S. G. S.

2000. *Hall Effect in the Electric Arc.* **C. D. Child.** (Phys. Rev. 18. pp. 370–371, May, 1904. Abstract of paper presented at a meeting of the American Physical Society, Feb. 27, 1904.)—If two carbon pencils are so placed in an arc that there is little or no potential difference between them, a potential difference is produced by creating a magnetic field about the arc. This may be as high as 1·5 volts. The effect cannot be produced by blowing the arc on one side, nor by moving the pencils to one side of the arc. The effect decreases with decreasing strength of field. The action disappears if the pressure be reduced to 1 cm. of mercury. J. E.-M.

2001. *Thermal Ionisation of Salt Vapours.* **G. Moreau.** (Comptes Rendus, 138. pp. 1268–1269, May 24, 1904.)—On heating in a porcelain tube to about 1,000°, the vapour of a salt becomes conducting, the conductivity depending on the nature of the salt. The author gives the results of the investigation in this way of a number of salts. The potassium salts conduct the best, and their conductivity limit depends on the nature of the acid radicle; Faraday's law is not obeyed in this case. This ionisation is not identical with that shown by salts in a flame, in which case the influence of the acid radical is very slight. T. H. P.

2002. *Microscopic Condition of the Poles during Discharges.* **B. Eginitis.** (Comptes Rendus, 138. pp. 1208–1210, May 16, 1904.)—The author points out that the appearance of the poles under the microscope is not the same for all metals, that of poles of Mn, Fe, Pt, and Ni being very different from that of poles of Pb, Al, and Sn. The former metals show, during discharge, brilliant points extending from the whole surface of the pole, while poles of the latter series of metals show sparks from only one point or a very small portion of the pole surface. Photographs with a very high magnification show that the brilliant points are centres of an emission of incandescent vapour, the number of points increasing with the self-induction of the discharge circuit up to a maximum and then rapidly decreasing. Increase of temperature of the poles also increases the number of luminous points, cooling producing the inverse effect. [See also Abstract No. 1430 (1903).]

L. H. W.

2003. *Forms of High-frequency Discharge between Fine Platinum Wires.* **A. Broca** and **Turchini.** (Comptes Rendus, 138. pp. 1489–1491, June 13, 1904.)—The authors, referring to the phenomena noticed by Eginitis [see preceding Abstract], describe some other somewhat analogous effects noted during their researches on the decay of currents in high-frequency circuits. Using either an interrupted or an alternating current in the primary for producing the discharge, and having a galvanometer in circuit, it was noticed that deflections in both directions were obtained and a change in the sound of the spark took place as soon as a considerable capacity was introduced. In investigating the cause of these phenomena, using platinum points for the discharge, it was found that there are three different kinds of discharge effects (with wire 0·5 mm. diam.): (1) The ordinary active spark (with large capacity) giving 40 milliamps. on the alternating-current ammeter and 0 on the galvanometer. (2) On heating one of the wires slowly and separating them, a blue film enveloped the wire; no Pt lines are seen in the spectrum, and there is no incandescence. The ammeter shows only 10 milliamps. and the galvanometer the same, showing the discharge is unidirectional, the glow being on the kathode. (3) On heating a little further, the wire with the glow becomes incandescent, the galvanometer goes back to zero and gives a reversed deflection, showing that the glow is anodic, and the spectrum shows all the Pt lines; oxidation of the platinum is also believed to take place. The experiments were repeated with a magnetic field in place of the ammeter, and the deviation caused by the field is found to be all in the same direction, but very little in amount in the case of discharge of type 2 (probably very heavy ions). In the type 3 discharge the ions were deviated in both directions, showing the complexity of the phenomenon. [The original title is erroneously given as "formes de l'éclairage," *for* which *read* "de la décharge."]

L. H. W.

ELECTRICAL PROPERTIES AND INSTRUMENTS.

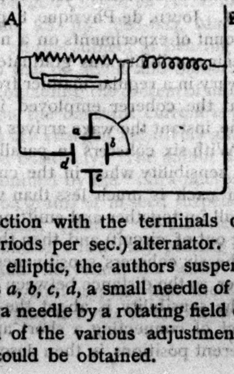
2004. *Electric Perforation of Solid Dielectrics.* **J. Kiessling** and **B. Walter.** (Ann. d. Physik, 11. 3. pp. 570–588, June 4, 1903. Physikal. Staatslaboratorium, Hamburg, April, 1903.)—When testing for dielectric strength near the edge of a sheet of insulating material or the end of a tube (*e.g.*, an ebonite tube for an induction coil), difficulty arises on account of the discharge "striking round," and this cannot be got over by inserting the margin of the substance in an insulating oil, for it is found that the breakdown then occurs always exactly at the surface of the oil. It has, further, long been known (Waltershofen, Dingler's Jour., 1866, p. 433) that if a drop of paraffin wax is spilt on a glass plate, puncture due to electrostatic stress will sooner occur at the margin of the drop than elsewhere. The authors investigate this effect, and show that the discharge from the electrode (which spreads almost uniformly over a uniform plate) is, by the drop of solid dielectric, concentrated almost exclusively along a line—the margin of the drop—and on this line, therefore, the breakdown occurs. They find (*a*) that the drop may be of the same material as the plate; (*b*) that, with irregularly shaped splashes of the solid dielectric, breakdown occurs at a re-entrant angle; and (*c*) that if the drop be slit across with a knife, puncture will occur in the slit. Walter has shown [see Abstracts Nos. 278 and 1890 (1899)] that the conducting path for a spark in air is always prepared by a number of impulsive brush discharges along the same path each a little longer than the last, the conductivity of the path being thus successively increased. In this way the margin of the drop or the cut becomes rapidly a conducting line. Remarkable experiments are quoted, proving the small potential gradient along this marginal line or cut. Polarity of the source of charge is of little moment. To obtain the minimum electrostatic pressure which would pierce a given insulating sheet, the authors tried restricting the surface discharge to a point by making a needle-prick through the centre of the wax drop. A greatly reduced breakdown voltage resulted, as in this example: An ebonite sheet, 50 cm. square and 4·2 mm. thick, which could withstand a 50-cm. spark-gap if the surface of the sheet was untouched, was found to give way under 20–30 cm. of spark-gap with the wax drop as above. But with a needle-hole in the centre of this drop, a 10-cm. spark-gap sufficed to puncture the plate in a few seconds. The electrode was not inserted into the small hole, but was 1–3 mm. away from the surface of the drop (which latter was about 2 cm. diam. and 2 mm. thick). No drop was on the other side of the plate, and the other electrode was also 1 to 3 mm. away from the surface. For glass sheets over 10 mm. thick, wax is too soft. The drop can then be of 1 part of colophonium to 14 of Venetian turpentine melted on to the plate and then pierced by a needle. The author's method of testing dielectric strength is similar to that of Rhumkorff and Holtz (Pogg. Ann., 1867, p. 121), but much more convenient. Breakdown is caused simply by sustained voltage, and does not depend on quantity of charge. Condensers are therefore only wanted when (as with influence machines) they are instrumental in producing the required voltage. If, when testing glass, a puncture occurs, then, if the discharge has not been too violent, and time elapses before the next discharge, the puncture may heal itself so perfectly that a further puncture may not even occur along the same path. This effect is carefully studied, and appears to be due to rigidity of the substance. It does not occur in ebonite. The method of test can be carried out on soft insulators by simply pricking the surface with a needle. Examples of such tests are given. The authors conclude that breakdown occurs primarily at the surface. They show that a faulty sheet with two new surfaces is relatively sound, and that a glass sheet with a bubble inside it is not specially weak at this point. The path of the discharge is round the bubble. Bubbles opening on to the surface are, however, a great source of weakness, since they concentrate the surface discharge. These experiments show how important it is with materials which have to be subjected to severe dielectric stress, to avoid the slightest pricking or cracking of the surface during either manufacture or use. [See also Abstract No. 1783B (1904).] D. K. M.

2005. *Electric Discharges in Solid Insulators.* **W. Holtz.** (Ann. d. Physik, 12. 1. p. 224, July 21, 1903.)—Referring to the recent work of Kiessling and Walter [see preceding Abstract], Holtz claims priority for many of their observations. His paper was published in 1876 in the Berliner Akademieberichte. In particular, the process of preparing the break-down path by preliminary brush discharges of gradually increasing length was observed by him. D. K. M.

2006. *Dielectric Constant of Water at Low Temperatures.* **O. U. Vonwiller.** (Phil. Mag. 7. pp. 655–662, June, 1904. Paper read before the Royal Society of New South Wales.)—The author has carried on experiments to investigate the dielectric constant in the neighbourhood of 4° C. and to determine whether there is a critical point at this temperature. The experiments were carried out with electrical oscillations of high frequency, produced in a Lecher wire system by the oscillatory discharge of a condenser. The results show that the dielectric constant continually diminishes as the temperature rises from 0° C., whereas C. B. Thwing found that the dielectric constant rose to a maximum value at 4° and then decreased as the temperature rose. From four sets of results the change of capacity for 1° rise in temperature, expressed as percentage of the capacity at 0° C., is 0·464, 0·478, 0·287, 0·344 respectively. E. S. A. R.

2007. *Edge Corrections in the Calculation of Absolute Capacity of Condensers.* **J. G. Coffin.** (Amer. Acad., Proc. 39. No. 19. pp. 415–437, April, 1904.)—The following are the more important of the cases worked out: (1) Two semi-infinite planes, one of whose edges extends beyond the other. (2) A square edge facing a semi-infinite plane which may extend beyond the edge. (3) Two square edges, one of which extends beyond the other. In this case it is noticeable that if one of the plates projects beyond the other by not less than from ten to twenty times the distance between the planes, it acts practically as an infinite plane, as far as the electricity on the inside face is concerned. (4) A plate of finite width, which is at potential V, near to and parallel to an infinite plane at potential zero. J. E.-M.

2008. *Realisation of Rotating Electrostatic Field.* **C. E. Guye** and **P. Denso.** (Écl. Électr. 39. pp. 201–210, May 7, 1904.)—In order to overcome the difficulty of producing a *rapidly* rotating electrostatic field by the rotation of electrified conductors, the authors constructed an apparatus consisting of four plate electrodes, each 2·5 cm. square, the connections being arranged as shown in the sketch, in which *a*, *b*, *c*, and *d* represent the electrodes, and



A and B wires in connection with the terminals of a single-phase high-frequency (250 to 1,200 periods per sec.) alternator. In order to test whether the field was circular or elliptic, the authors suspended in the space surrounded by the electrodes *a*, *b*, *c*, *d*, a small needle of aluminium; no torque would be exerted on such a needle by a rotating field of constant intensity. A detailed account is given of the various adjustments by means of which a circular rotating field could be obtained. A. H.

2009. *Mercury Standards of Resistance.* **F. E. Smith.** (Roy. Soc., Proc. 73. pp. 239–243, April 9, 1904. Abstract. From the National Physical Laboratory.)—According to the definition of the international ohm, the resistance of a uniform column of mercury of length L(cm.), and of mass W(gm.), is $L^2 \times 14{\cdot}4521/W \times (106{\cdot}3)^2$ international ohms. The construction of a standard thus involves the measurement of a length and a mass. A quantity proportional to L^2/W was first determined for various similar lengths of a selected tube which was then broken into three parts, the positions of the fractures being carefully chosen so that a mercury column occupying the middle portion should have a nominal resistance of 1 ohm. The value L^2/W for this portion was calculable with considerable accuracy from the previous observations. Difficulties and errors are touched upon, and a comparison between the calculated values and those obtained by measurement with a B.A. standard is given in a table. The following are expressions for the temperature coefficients of mercury under three conditions: (1) In Jena 16‴ glass $R_T = R_0[1 + 0{\cdot}00088018T + 0{\cdot}00000105793T^2]$. (2) In "verre dur" glass $R_T = R_0[1 + 0{\cdot}00088036T + 0{\cdot}00000103094T^2]$. For a constant volume of mercury deduced from (1), $R_T = R_0[1 + 0{\cdot}00088788T + 0{\cdot}0000010564T^2]$, and from (2), $R_T = R_0[1 + 0{\cdot}00088776T + 0{\cdot}0000010376T^2]$, T being temperature on the hydrogen scale. J. D. C.

2010. *Measurement of Small Inductances and Capacities.* **J. A. Fleming.** (Phys. Soc., Proc. 19. pp. 586–595, 1904. Phil. Mag. 7. pp. 586–595, May, 1904.)—A convenient and rapid method of determining coefficients of self-induction and capacities by comparison one with the other, to within an accuracy of 2 per cent. is described. Tables of measurements made on various coils are given, and also a calibration curve for a variable inductance, of the coil and sliding contact form. The method is the bridge arrangement of Anderson (Electrician, 27. p. 10, 1891), modified by the use of a telephone and buzzer in place of a galvanometer and battery key. The ordinary expression for the coefficient of self-induction (L) of a straight cylindric solenoid without iron can be thrown into a more convenient form which may be expressed in words as: L = (length of wire per unit length of solenoid) × (total length of wire in solenoid). As in the ordinary expression no allowance is made for end effects. J. D. C.

2011. *Operation of Joined-up Coherers.* **A. Turpain.** (Soc. Franç. Phys., Séances, 1. pp. 5–11, 1904. Journ. de Physique, 3. pp. 443–450, June, 1904.)—The author gives an account of experiments on a number of coherers joined up in various ways. Their sensibility was graduated by making the distance between the electrodes vary in a regular manner from one to the other of the series. It is shown that the coherer employed is more sensitive when a current is passing at the instant the wave arrives (closed circuit) than when no current is passing. With six coherers in parallel, though they each preserve the same relative sensibility when in the currentless condition (open circuit), the sensibility of each is much less than when they are in a closed circuit; and by joining all up together and emitting waves so that first one is cohered (and is then cut out of circuit) and then the next, he obtains an idea of the order in which the six coherers' sensitiveness stands; and this is not always in the same order as the distance between the electrodes. With the six coherers in series the sensibility is about the same in a closed as on open circuit. The effect of connecting a short antenna (60 cm.) to one or more points, and at different positions, is then described, as also the arrangement of the coherers two in series in each of three branches in parallel. The experimental arrangement is considered convenient for following the progress of thunderstorms, as well as, according to the author, for Hertzian telegraphy either with or without wires. L. H. W.

2012. *Hot-wire Ammeter for Small Currents.* **J. A. Fleming.** (Phys. Soc., Proc. 19. pp. 595–604, 1904. Phil. Mag. 7. pp. 595–604, May, 1904.)—This is a special form of compensated sagging-wire instrument for the measurement of alternating currents of a few milliamperes. It consists of two very thin platinoid wires about 1 m. long running parallel along the axis of a square tubular wooden box, and regulated as to tension by springs and adjusting screws at each end. At the middle the two wires are bridged by a light paper strip carrying a small mirror. The current to be measured is sent through one wire, and the sag produced is taken up by a light platinoid spring attached to its middle point. The other wire remains taut, and in consequence the mirror is deflected. The latter wire is provided with a similar platinoid spring, parallel to that attached to the first wire, so that extraneous variations of temperature do not influence the indications because they cause both wires to sag equally. A convenient zero position is given to the mirror by means of the end adjusting screws. The author shows how the instrument may be readily calibrated, and gives examples of its use in determining small capacities and the magnetising currents of small transformers. J. D. C.

ELECTROPHYSIOLOGY AND ELECTROTHERAPEUTICS.

2013. *Rapid Expulsion of Calculi by High-frequency Treatment.* **A. Moutier.** (Comptes Rendus, 138. pp. 1285–1287, May 24, 1904.)—The author has several times observed that treatment by auto-conduction of cases of arterio-sclerosis, with a view to lowering the blood pressure, has led to the appearance of gravel and small calculi in the urine. Two cases are described in which the patients who suffered from symptoms of renal and vesical calculi were treated by high-frequency currents. In each case small calculi were passed after the first séance. H. W. P. Y.

2014. *Action of the Constant Current on Toxins and Antitoxins.* **S. Leduc.** (Archives d'Él. Médicale, 12. pp. 383–385, May 25, 1904.)—The author reviews the work done on this subject in Behring's Institution at Marburg, and especially refers to that of Much and Siebert on the effect of the constant current on a fluid containing the protein of milk, which has a bactericidal action on B. coli. When the constant current is passed through this fluid, the molecules of protein are charged negatively and the liquid in which they are suspended is charged positively. The author describes an experiment of his own in which he examined by the "ultra-microscopic" method the effect of the constant current on grains of linseed suspended in pure water. After the passage of a sufficient quantity of electricity the grains of linseed accumulate around the anode, a few only passing to the kathode. Those at the anode are dried and shrivelled, the water being transported to the kathode. From this it would appear that the grains of linseed become charged negatively and play the *rôle* of anions, while the water is charged positively. H. W. P. Y.

REFERENCES.

2015. *Absence of Electrification in Condensation and Evaporation.* **C. Barus.** (Phys. Rev. 16. p. 384, June, 1903. Paper presented at the meeting of the Amer. Physical Society, April 25, 1903.)—By means of observations on the leakage of a charged graduated electroscope, tests were made to find whether in the case of *sudden* condensation and the rapid evaporation of fog particles any electrification is produced, such electrification being so marked when a mass of water is suddenly shattered, as in jets. No electrification, however, was found on the alternate sudden production and sudden dissipation of fogs. J. J. S.

2016. *Ionisation of Air.* **J. Patterson.** (Phil. Mag. 6. pp. 231–238, Aug., 1903.)—Experiments made with air at different temperatures and pressures indicate that the so-called spontaneous ionisation in a closed vessel is due to slight radioactivity in the walls of the vessel. The radiation from the walls of the vessel was not affected by temperature up to 450° C. J. J. S.

2017. *Sensitive Galvanometer for Spectrobolometric Purposes.* **C. G. Abbot.** (Astrophys. Journ. 18. pp. 1–20, July, 1903. Paper read before Section B of the Amer. Assoc. for Advancement of Science, Dec. 30, 1902, after introductory remarks by **S. P. Langley.**)—The paper contains full details of the construction of an extremely sensitive galvanometer capable of measuring a current of 1×10^{-12} amp. E. C. C. B.

2018. *New Vacuum Regulator for Crookes Tubes.* **Krouchkoll.** (Comptes Rendus, 138. pp. 1338–1339, May 30, 1904.)—A subsidiary tube containing glass wool is connected to the Crookes tube, and heated when the latter becomes hard. G. E. A.

2019. *Magnetic Classification of Liquids and Crystals.* **G. Meslin.** (Comptes Rendus, 136. pp. 1438–1440, June 15, 1903.)—A table is given in which a series of liquids and solids are arranged in the order of their magnetic properties. The experimental method adopted consisted in comparing a liquid and solid with one another; in this way a liquid serves to separate a series of solids into two groups of higher and lower magnetic power, whilst conversely each solid serves to separate the liquids into two groups. In some cases no liquid could be found to separate a substantial group of solids, and conversely no solid could be found intermediate between the higher alcohols, but in most cases the unresolved groups only contain two or three liquids or solids. T. M. L.

2020. *A Hysteresis and Eddy-current Motor.* **L. Kann.** (Phys. Zeitschr. 4. pp. 561–563, July 15, 1903.)—The motor described by the author is not intended to be used commercially, but for purposes of scientific investigation. Four coils, arranged in two sets whose axes are perpendicular to each other so as to form a cross, are connected in series and traversed by the same alternating current. In the central space between the coils is pivoted or suspended a cylinder of silver or copper. So long as the coils have no cores, no torque is exerted on the cylinder. If now a bundle of iron wires is introduced into each of two coils in line with each other, a phase-difference results between the two fields due to the two sets of coils, and a torque is exerted on the cylinder. The author suggests that such an instrument may prove useful for investigating hysteresis in feebly magnetic bodies, and may be applied to the case of fluids, the fluid being contained in a bent glass tube whose straight ends fit into one pair of coils. A. H.

2021. *Deformation of a Ferromagnetic Wire in the Magnetic Field.* **F. Koláček.** (Ann. d. Physik, 14. 1. pp. 177–181, May, 1904.)—A mathematical treatment. J. W. P.

2022. *The Villari Critical Point in Nickel.* **K. Honda** and **S. Shimizu.** (Mathematical and Physical Soc. Tokyo, 2. 7. pp. 87–91, 1903.)—The Villari critical point has been well established in the case of iron. Heydweiller found it also in the case of nickel for weak fields. The authors take a rod of nickel having a length of 20 diam., and apply tension and compression by means of a lever. For the weak fields used great care has to be taken to remove residual magnetism. The result is that tension causes a decrease, compression an increase, in magnetisation. There is no Villari reversal, and the authors consider that the result found by Heydweiller was due to a spurious influence, perhaps permanent strain in the thin wire used by him. P. E. S.

2023. *Villari Critical Point in Nickel.* **A. Heydweiller.** (Phys. Zeitschr. 5. pp. 255–256, May 1, 1904. Physik. Inst. d. Univ. Münster, March, 1904.)—The author considers that the negative evidence of Honda and Shimizu [see preceding Abstract] as to the presence of the critical point in nickel, is not sufficient to discredit his own positive results, which were independently corroborated by G. S. Meyer (Wied. Ann. 59. p. 134, 1896). The rod used by these authors is considered to have been too thick and short, whereby the transverse magnetisation was relatively large. L. H. W.

2024. *Comparison of Methods of Reducing Magnetic Hysteresis.* **C. Maurain.** (Soc. Franç. Phys., Séances, 2. pp. 67–84, 1904. Journ. de Physique, 3. pp. 417–434, June, 1904.)—A more detailed account of the experiments described in Abstract No. 376 (1904), giving the figures of the results obtained.

2025. *Capacities in Terms of Coefficients of Electrostatic Induction.* **G. F. C. Searle.** (Cambridge Phil. Soc., Proc. 12. pp. 378–387, April, 1904.)—Mathematical paper dealing with the case where there are n conductors of varying electrical condition, as well as form and position, in the field. The definitions of capacity of a conductor and of the capacity between two conductors have to be modified to meet this case. A. D.

2026. *Electrolytic Phenomenon.* (Scientific American, 90. p. 290, April 9, 1904.)—Reference is made to a curious effect noticed by J. Bing. In an electrolyte of tartaric acid put a lead kathode and an aluminium anode; connect the Al anode with the terminal of a condenser, and from the other terminal bring a wire almost back to the Al anode. A discharge is produced between the point of this wire and the anode, the interruptions being accompanied by a high-pitched sound. A. D.

2027. *Ionisation in Air and Hydrogen.* **R. K. McClung.** (Cambridge Phil. Soc., Proc. 12. pp. 375–377, April, 1904.)—Particulars of the balance method described in Abstract No. 1496 (1904).

2028. *Harmonic Analyses of the Diurnal Magnetic Variations at the Cape of Good Hope and at Hobart.* **G. Heimbrod.** (Terrestrial Magnetism, 9. pp. 9–14, March, 1904.)—The author, living at Suva, Fiji, has reduced by harmonic analysis Sabine's observations at Cape Town (1842–1846) and Hobart (1842–1848). The work is done in conjunction with A. Nippoldt and by his method. The paper comprises six tables, one of them showing the parts which the wave w_1 and the combination wave w_{2+3} play in forming the diurnal variation. The addition of w_4 would have affected the combination only slightly. The data from Melbourne and Christchurch will likewise be analysed. H. B.

CHEMICAL PHYSICS AND ELECTRO-CHEMISTRY.

2029. *Measurement of the Diffusion of Salts in Solution.* **J. C. Graham.** (Roy. Soc., Proc. 72. pp. 212–217, Aug. 31, 1903.)—A layer of salt-solution of density 1·0269 was introduced below a layer of water in a vessel of special form which is described in the paper, and after diffusion had proceeded for 111¼ hours the different strata were drawn off and their densities determined. The diffusion constant xt for the 111¼ hours was 3·95, whence $x = 0{\cdot}0355$. The distribution of the chloride above and below the original boundary can be calculated from Fourier's equation, which gives a symmetrical curve, and this was used to calculate the diffusion-constant by a graphical method.

T. M. L.

2030. *Dulong and Petit's Law.* **C. Puschl.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2a. pp. 1230–1245, Oct. and Nov., 1903.)—The author considers it probable that the equivalent weights of the elements are not constant magnitudes, but that they vary with the external conditions. It is also likely that the elements obey the law of Dulong and Petit also in their compounds, so that if an element exhibits a specific heat in the combined state different from the value in the free state, its equivalent weight must be regarded as correspondingly changed. If the product of the normal equivalent weight, a, of an element and its specific heat, γ, is approximately 6, γ is the normal specific heat of the element. If, however, in a compound this element has a different specific heat, γ', its equivalent weight, a', must fulfil the condition, $a'\gamma' =$ about 6. For all elements, in compounds of the most varied type, the values of $a\gamma'$ are represented by a few numbers which are simply related to one another; these numbers are 12, 6, 3, and 1·5. For the metals, $a\gamma'$ has, with few exceptions, the value 6. For silicon, beryllium, nitrogen, sulphur, chlorine, bromine, iodine, and fluorine, the values are 6 and 3; for phosphorus always 6; for bromine only 3; whilst for chlorine the value is sometimes 12. For carbon, hydrogen, and oxygen, $a\gamma'$ has the values 6, 3, and 1·5, but in gaseous compounds hydrogen also exhibits the value 0·75. When a molecule contains two atoms of an element, one of these atoms may have the value 6 for $a\gamma'$, and the other 3, and so on. In this way can be explained the variable equivalent heats of elements in their compounds. If for any solid or liquid compound, Σ represents the sum of the atomic weights of the elements it contains, and W the sum of the values of $a\gamma'$ for these elements, then the specific heat is expressed by $c = W/\Sigma$. With boric acid, for example, $\Sigma = 70$, and taking $a\gamma'$ for boron as 3 and for the three oxygen atoms as 6, 3, and 1·5 respectively, $W = 16{\cdot}5$; the specific heat will hence be $16{\cdot}5/70 = 0{\cdot}236$, which agrees well with the experimental number, 0·237. In a number of other examples given similar concordance is met with. The author regards the equivalent weights of the elements as those weights which contain a constant sum of radiating atomic surfaces. This view may be used to explain how it is that a normal element, *e.g.*, iodine, is able to double its specific heat on melting. We may consider the atom of iodine to consist of eight smaller atoms joined together so as to present a surface impenetrable by the ether. If, on liquefaction, these small atoms become separated from one another by thin layers of the ether, the sum of the radiating surfaces and, with it, the specific heat becomes doubled, while the equivalent weight remains unchanged. T. H. P.

2031. *Production of Silicides.* **R. Amberg.** (Metallurgie, 1. pp. 118–121, April 8, 1904. Institut f. Metallhüttenwesen u. Elektrometallurgie d. Königl. Techn. Hochschule, Aachen.)—Experiments have been made to test the question whether silicides can be obtained by heating a mixture of sulphides and silica. Preliminary trials were made with mixtures of SiO_2 and FeS heated in a gas furnace. The results being unsatisfactory, it was decided to adopt the electrical method of heating. Various types of furnaces were used from those supplied with 50–90 amps. to larger types requiring 400 amps. In every case the yield of silicide was but small. The chemical actions that take place are discussed. W. W. H. G.

2032. *Determination of the Relation between Concentration and Coefficient of Diffusion by Means of Curved Light Rays.* **F. Heimbrodt.** (Ann. d. Physik, 13. 5. pp. 1028–1043, April, 1904. From the Leipziger Inaugural Dissertation, 1903.)—Using a Hallwachs' prism, the author determines the indices of refraction for green light ($\lambda = 560\ \mu\mu$) of solutions of urea, glycerine, sodium chloride, and hydrochloric acid at temperatures between 11° and 16°. The coefficients of free diffusion, which are determined with a mean error of 0·4 per cent., change in a regular manner with the concentration. With increasing concentration sodium chloride and urea exhibit a linear decrease, and hydrochloric acid a linear increase, of the diffusion coefficient. With glycerine this coefficient at first falls proportionally with the concentration, but at a greater rate as the latter increases. The following table gives the main results obtained by the author :—

Mean Concentration of the Two Diffusing Solutions.	Coefficient of Diffusion in Gm. per Sq. Cm. per Day.			
	Glycerin 10·14°.	Urea 14·83°.	NaCl 14·33°.	HCl 14·30°.
$\frac{1}{8}$-*n*	0·356	0·973	1·020	2·208
$\frac{1}{2}$-*n*	0·350	0·946	0·996	2·331
$\frac{7}{8}$-*n*	0·342	0·926	0·972	2·480
1·5-*n*	0·315	0·883	0·932	—

T. H. P.

2033. *Behaviour of Hydrated Chlorides when Heated in Hydrogen Chloride.* **F. A. Gooch and F. M. McClenahan.** (Amer. Journ. Sci. 17. pp. 365–376, May, 1904. Contribution from Kent Chem. Laboratory, Yale University.) —The products obtained on heating hydrated metallic chlorides in air vary with the nature of the chloride and with the temperature, and may be the anhydrous chloride and water or hydrogen chloride and oxychloride, oxide or hydroxide. The decomposition may be changed if the heating take place in an atmosphere of hydrogen chloride. The chlorides examined by the author are : (1) $BaCl_2, 2H_2O$, which loses water without hydrogen chloride ; (2) $MgCl_2, 6H_2O$, which gives up some hydrogen chloride with the water ; and

(3) $AlCl_3, 6H_2O$, in which the whole of the chlorine is evolved as hydrogen chloride at the same time as the water. The authors' results show that hydrogen chloride is without influence on the dehydration of hydrated barium chloride at temperatures not exceeding 100°, at which the process is complete. With hydrated magnesium chloride, hydrogen chloride appears to have little or no effect on the loss of the first $2H_2O$ (which goes off at 100°), but it delays the loss of water when the salt is placed directly in it at 100–130°, and hastens it when above 130°; the hydrolytic dissociation of the salt is not very marked in either air or hydrogen chloride until the temperature approaches 200°. The dehydration of hydrated aluminium chloride is inhibited in an atmosphere of hydrogen chloride until about 130° is reached; above 130°, as in air above 100°, water and hydrogen chloride are simultaneously evolved. The authors explain this behaviour by means of the formulæ given by Cushman, who assumes the oxygen in these hydrated chlorides to be tetravalent and the chlorine sometimes trivalent. If, also, the greater or less stability of the hydrated chlorides is conditioned by the varying energy content of the compounds, Cushman's formulæ show how the retardation of the splitting-off of hydrogen chloride in an atmosphere of the latter is connected with a retention of the water of hydration. T. H. P.

2034. *Reduction of Silica by Hydrogen.* **A. Dufour.** (Comptes Rendus, 138. pp. 1101–1103, May 2, 1904.)—On passing a current of hydrogen through a silica tube heated until soft in an oxyhydrogen flame, a deposit of silica, either alone or mixed with silicon, is formed in the tube, the silica being reduced by the hydrogen forming silicon hydride and water vapour, which react together in the reverse direction at a slightly lower temperature. When, however, this reverse reaction is incomplete, some of the silicon hydride is decomposed, yielding silicon and hydrogen. A silica rod loses weight when heated in an oxyhydrogen flame, a rod 970 m.gm. in weight losing 500 m.gm. in 15 min. That the above-described deposition of silica and silicon is not due to the volatility of the silica and its partial dissociation is proved by Moissan's work, which showed that silica is not appreciably volatile at the temperature of these experiments. Further, if oxygen or carbon monoxide is passed through the silica tube in place of hydrogen, no deposit forms. The loss in weight of the silica rod when heated varies with the nature of the gas employed as source of heat, being greatest for a mixture of oxygen and hydrogen, and least for oxygen with carbonic oxide. T. H. P.

2035. *New Method for Exact Determination of Molecular Weight of the Permanent Gases: Atomic Weights of Hydrogen, Carbon, and Nitrogen.* **P. A. Guye.** (Comptes Rendus, 138. pp. 1213–1215, May 16, 1904.)—From van der Waals' equation of state, it is possible to derive the relation: $V_m(1+a)(1-b) = R + mT_c$, where V_m is the volume of a gm.-molecule at 0° and 1 atmosphere, a and b are constants, R the gas constant for perfect gases (22410·4), T_c the absolute critical temperature, and m a factor having the value 0·08478. Taking the molecular weight of oxygen as 32, the following values are obtained for those of other gases: hydrogen, 2·0153; nitrogen, 28·008; carbonic oxide, 28·003. These numbers give the atomic weights: $O = 16$, $N = 14{\cdot}004$, $C = 12{\cdot}003$, $H = 1{\cdot}00765$. These values agree well with those obtained in other ways. Stas' value for nitrogen, 14·057, is hence too high. T. H. P.

2036. *Apparent Volatilisation of Silicon in Hydrogen.* **A. Dufour.** (Comptes Rendus, 138. pp. 1169–1170, May 9, 1904.)—On filling a Geissler's tube at a pressure of 1–2 mm. with a mixture of hydrogen, SiH_4 and Si_2H_6, and heating the capillary portion of the tube to a low red heat, a layer of silicon is formed in the tube. If the tube is illuminated by means of an induction apparatus there immediately forms on the walls of the tube and the electrode a brown precipitate, which, if the action of the induction apparatus is prolonged, passes into the Faraday dark zone with the previously deposited silicon. If now the current direction in the tube is changed, the dark zone and with it the precipitate changes its position. This migration of the silicon is explained by the fact that at the high temperature of the electric discharge the separated silicon forms silicon hydride, which then becomes decomposed in the Faraday dark zone. The volatilisation of silicon in a Geissler's tube is hence only apparent, although the migration of arsenic in such a tube filled with hydrogen arsenide is due simply to the distillation of the arsenic. T. H. P.

2037. *Connection between Volatility of Compounds and the Intra-moleculai Forces.* **G. Martin.** (Chem. News, 89. pp. 241–242, May 20, 1904.)—From results obtained with a number of compounds, the author draws the following conclusions: Chemically unstable compounds are, as a class, characterised by their volatility and fusibility, and chemically stable ones by their non-volatility and infusibility. Compounds containing atoms of high valency are usually volatile and fusible, those with atoms of low valency not so. Compounds which react in a very similar way with different reagents usually approach each other closely as regards volatility. The volatility of any compounds depends almost entirely on the intensity of the chemical forces with which the atoms composing it attract other atomic species.
T. H. P.

2038. *Saturated Aqueous Solutions of Sparingly Soluble Salts.* I. *Electrical Conductivity.* **F. Kohlrausch,** with **F. Rose** and **F. Dolezalek.** (Zeitschr. Phys. Chem. 44. pp. 197–249, June 23, 1903.)—Tables are given showing the conductivity at different temperatures of saturated solutions of 41 salts, including the fluorides of Ba, Sr, Ca, Mg, Zn, and Pb; the chlorides of Ag, Tl′, and Hg′; the bromides of Ag and Tl; the iodides of Ag, Tl′, Cu′, and Hg″; CuSCN; the iodates of Ag and Pb; the sulphates of Ba, Sr, Ca, and Pb; the chromates of Ba, Ca, Ag, and Pb; the carbonates of Ba, Sr, Ca, Mg, and Pb, and the oxalates of Ba, Sr, Ca, Mg, Zn, Cd, Pb, and Ag. In the case of calcium chromate there is a great difference between the solubility of the hydrated and anhydrous forms; the conductivity of a solution saturated with the anhydrous salt increased from 0·001070 at 11 min. to 0·001520 at 6 hours, 0·003090 at 8 days, 0·014900 at 15 months, and 0·015400 at the end of 4 years. T. M. L.

2039. *Estimation, Solubility, and Interaction of Ozone with Hydrogen Peroxide.* **J. K. H. Inglis.** (Chem. Soc., Journ. 83. and 84. pp. 1010–1014, Aug., 1903.)—The estimation of ozone in acid solutions by means of potassium iodide gives high results, probably owing to the oxidation of hydriodic acid. An attempt was, therefore, made to estimate the ozone by oxidation of hydrobromic acid $O_3 + 2HBr = Br_2 + O_2 + H_2O$ and subsequent interaction of the bromine with potassium iodide, but the results were not specially concordant, and were low as compared with those obtained in neutral potassium iodide solution. Confirmation was obtained of Schöne's conclusion that ozone is decomposed by passing through water, and its "solubility" cannot therefore be determined. Confirmation was also obtained of Schönbein's observation that ozone and hydrogen peroxide tend to destroy one another. The passage of ozonised oxygen through hydrogen peroxide solution diminished the concentration in the ratio 14·8 to 1·6 in 205 min., whilst a similar current of oxygen caused a decrease from 24·0 to 23·6 only in 410 min. T. M. L.

2040. *Solubility of β-l-Asparagine and β-l-Aspartic Acid.* **H. W. Bresler.** (Zeitschr. Phys. Chem. 47. pp. 611–617, March 31, 1904.)—Former values given for the solubilities of β-*l*-asparagine and β-*l*-aspartic acid in water differ widely. The following are the values obtained by the author, starting from both unsaturated and supersaturated solutions:—

Temp.	Gm. of Asparagine (+ H_2O) in 100 gm. of Water.	Temp.	Gm. of Aspartic Acid in 100 gm. of Water.
0·7°	0·9546	0·2°	0·2674
7·9	1·4260	9·5	0·4042
17·5	2·1400	16·4	0·5176
28·0	3·1710	31·5	0·7514
41·4	5·6500	40·0	0·9258
55·5	10·6500	51·0	1·2746
71·7	19·8380	63·5	1·8147
87·0	36·5640	70·0	2·3500
98·0	52·4750	80·5	3·2106
—	—	97·4	5·3746

The solubility curves are hyperbolæ whose formulæ are given. T. H. P.

2041. *Solubility as Influenced by Dimensions of Solid Particles.* **G. A. Hulett.** (Zeitschr. Phys. Chem. 47. pp. 357–367, March 1, 1904. University of Michigan, Aug. 8, 1903.)—A normal saturated solution of a substance is one that is in equilibrium with a flat surface of the substance. In the case of gypsum this can be prepared by gently stirring the solution above a few coarsely broken crystals previously rinsed to remove small particles. Its conductivity at 25° is 0·002208 cm. ohm^{-1}, and it contains 15·30 millimols. per litre. The same value is obtained by stirring a supersaturated solution. On adding a little finely powdered gypsum the conductivity rises to a maximum at about 0·002570, but falls again in a few days to 0·002210 as the finer particles become dissolved. A solution filtered from these very fine particles showed a solubility 13·2 per cent. above the normal. The values given by Kohlrausch for the conductivity of solutions of gypsum saturated at different temperatures are substantially those for normal saturated solution, except in the case of the conductivity near 0°, which is about 5 per cent. too high: $\lambda = 0·001081$ instead of 0·001032. Kohlrausch's solutions were prepared by using 10–20 gm. of powdered gypsum, but this was washed two to four times before use and would therefore be free from all but the finest particles. So also in the case of barium sulphate, in which Kohlrausch found identical values after a month and after 2½ years, the preparation was washed again and again during the first month, and the conditions were therefore not favourable for observing the influence of the size of the particles on the solubility of the salt. The conductivity of the solution rises, however, from $\lambda_{25} = 4·07 \times 10^{-6}$ to $4·92 \times 10^{-6}$ when a little finely powdered sulphate is added to the normal saturated solution.

T. M. L.

2042. *Colloidal Gold.* **Hanriot.** (Comptes Rendus, 138. pp. 1044–1046, April 25, 1904.)—Colloidal gold prepared by reducing an alkaline solution of gold chloride with pyrocatechol and afterwards acidifying, is a bluish-violet powder readily soluble in water, but insoluble in presence of excess of sulphuric or nitric acid or in solutions of the alkali salts of these acids. In solutions of the alkalies, especially of ammonia, it is readily soluble and excess of ammonia may be boiled off without precipitating the gold. Strong acids, however, throw down a precipitate containing water of constitution, which it loses at 100°, becoming then insoluble in alkalies. Many salts of the heavy metals give, with colloidal gold solution, a precipitate which does not consist of metallic gold, but contains the characteristic complex of colloidal gold.

T. H. P.

2043. *Lead-Aluminium Alloys.* **H. Pécheux.** (Comptes Rendus, 138. pp. 1042–1044, April 25, 1904.)—Molten mixtures of aluminium and lead, containing less than 90 per cent. of the former metal, separate, on cooling, into three layers, the lower one consisting of lead, the middle one of an alloy containing 90–97 per cent. of aluminium, while the upper one is aluminium. Of the alloys obtained in this way, those containing respectively 93, 95, and 98 per cent. of aluminium have the densities 2·745, 2·674, and 2·600, and have nearly the same colour as aluminium; they are malleable and are readily cut with the chisel, showing a silvery surface, but are not so hard as aluminium and are easily bent. That they are not definite compounds is shown by the fact that, when re-melted and cast, they yield alloys containing 92, 94, and 96 per cent. respectively of aluminium and having the densities 2·765, 2·691, and 2·671. This tendency to liquate necessitates the rapid cooling of the molten alloys. The alloys do not oxidise in moist air or in the molten state. They are attacked at ordinary temperatures by concentrated hydrochloric or sulphuric acid with evolution of hydrogen, and by hot sulphuric acid which evolves sulphur dioxide and by hot nitric acid with generation of nitric oxide; the latter acid has little action in the cold, and the same is the case with dilute acids, even when heated. Concentrated potassium hydroxide solution and *aqua regia* act vigorously even in the cold, but distilled water is without action even at the boiling-point; hydrogen sulphide blackens to a slight extent the alloys containing 92 and 93 per cent. of aluminium.

T. H. P.

2044. *Aluminium-Tin Alloys.* **E. S. Shepherd.** (Journ. Phys. Chem. 8. pp. 233–247, May, 1904.)—Between 10 and 50 per cent. aluminium, the author found that an increase of aluminium was always accompanied by a rise of freezing-point. By pipetting samples off from top and bottom of the molten alloy containing 18 per cent. aluminium, in some cases with a small percentage of lead added, it is shown that there is no tendency to separation into two liquid layers. From analyses of alloys of aluminium and tin with silver the author believes that a solid solution does exist. From the curve of specific volumes, from the microstructure, and from the thermal measurements, the author concludes that 20 per cent. tin is the limiting concentration of tin in aluminium.

F. R.

2045. *Zinc-Aluminium Alloys.* **H. Pécheux.** (Comptes Rendus, 138. pp. 1103–1104, May 2, 1904.)—The author describes the following nine well-defined alloys: Zn_3Al, Zn_2Al, $ZnAl$, $ZnAl_2$, $ZnAl_3$, $ZnAl_4$, $ZnAl_6$, $ZnAl_{10}$, and $ZnAl_{12}$, of which the specific gravities at 16° have the respective values, 5·704, 5·488, 4·639, 3·685, 3·638, 3·400, 3·140, 3·084, and 3·040. The melting-points lie between those of zinc and aluminium and rise from Zn_3Al to $ZnAl_{12}$. All the alloys are brittle, and Zn_3Al and Zn_2Al show embedded crystals on the surface of fracture. The first three alloys are but slightly sonorous, the remaining ones exhibiting good resonance. All the alloys are readily attacked by concentrated or dilute hydrochloric acid, concentrated sulphuric acid, hot concentrated or dilute nitric acid, or hot concentrated potassium hydroxide solution. They are not attacked by hydrogen sulphide in the cold or by distilled water, even at 100°. T. H. P.

2046. *Property of Tin-Aluminium Alloys.* **H. Pécheux.** (Comptes Rendus, 138. pp. 1170–1171, May 9, 1904.)—On immersing in cold distilled water a rod of one of the four non-crystalline tin-aluminium alloys, Sn_5Al, Sn_3Al, Sn_2Al, and $SnAl_3$, the surface of which has been worked with the file, an abundant evolution of detonating gas takes place for two or three minutes at the filed surface of the alloy. This phenomenon is not observed with (1) a previously heated or filed tin or aluminium rod, or (2) a rod of the alloy not filed but heated to the same temperature as is produced by the filing. These tin-aluminium alloys must be formed, except at the hardened surface, by the juxtaposition of the molecules of the two metals, so that the filed surface acts, with the distilled water, like a number of small thermo-electric couples which immediately decompose the water. Boiling distilled water is decomposed by the non-filed tin-aluminium alloy, the heating apparently destroying the combination of the metals at the surface. If a filed tin-aluminium rod is dipped into a faintly acid copper sulphate solution, oxygen is evolved and copper deposited; a non-filed tin or aluminium rod, however, precipitates the copper but gives no gas evolution. Zinc sulphate behaves like copper sulphate, but the development of oxygen is not so vigorous. [See also Abstract No. 2043 (1904)]. T. H. P.

2047. *Compound of Ferric Sulphate with Sulphuric Acid.* **A. Recoura.** (Comptes Rendus, 137. pp. 118–120, July 13, 1903.)—When sulphuric acid (3 mols.) is added to a concentrated solution of ferric sulphate (1 mol.), the solution gradually changes from brown to colourless, with subsequent deposition of a white powder of the composition, $Fe_2(SO_4)_3$, H_2SO_4, $8H_2O$. This compound, which is also obtained with other proportions of the constituents than the above, is instantly decomposed by water, and in this respect differs from chromosulphuric acid, which is but slowly decomposed. It is a true acid with a complex radical and gives esters. T. H. P.

2048. *Formation of Solid Solutions from Nitro and Nitroso Derivatives.* **G. Bruni** and **A. Callegari.** (Accad. Lincei, Atti, 13. pp. 567–573, May 15, 1904.)—It is known that ortho-nitrobenzaldehyde forms solid solutions with the isomeric ortho-nitrosobenzoic acid, and as the carboxyl group in the latter is isomorphogenous with the aldehyde group in the former, it is to be assumed that the nitro and nitroso groups are also isomorphogenous, so that a given nitro compound may always be expected to form a solid solution with the corresponding nitroso compound. By the cryoscopic method the author has examined this assumption in the case of nitro and nitroso derivatives of benzene, of toluene, and of ethyl benzoate, and finds it to be justified for aromatic compounds at least. It appears, too, as the depression of the freezing-point is always proportional to the concentration, and, therefore, the coefficient of partition for the two phases is constant, that the nitroso derivatives in these solid solutions have simple molecular weights.

D. H. J.

2049. *Decomposition of Potassium Chlorate and of Sodium Chlorate and Perchlorate.* **J. Scobai.** (Zeitschr. Phys. Chem. 44. pp. 319–347, July 7, 1903. Physik. chem. Institut, Leipzig.)—The author finds that under no circumstances is equilibrium arrived at in the decomposition of potassium chlorate by heat, but that two simultaneous reactions go on, the primary one being represented by $4KClO_3 = 3KClO_4 + KCl$, and the secondary by $2KClO_3 = 2KCl + 3O_2$. On following the course of the decomposition quantitatively, it was found that at 395° the primary reaction is quadrimolecular and the secondary one unimolecular. When potassium chlorate is heated in fused potassium nitrate as solvent at 410°—at which temperature potassium nitrate is stable and has no action on the chloride or perchlorate—the two above reactions take place simultaneously. Sodium chlorate, when heated, behaves like the potassium salt, while sodium perchlorate, like other perchlorates, decomposes into chlorate, chloride, and oxygen. T. H. P.

2050. *The Enzyme of the Blood which Decomposes Hydrogen Peroxide.* **I. G. Senter.** (Zeitschr. Phys. Chem. 44. pp. 257–318, July 7, 1903. Physikal. chem. Institut, Leipzig.)—After a general discussion of the nature of enzymes; of the behaviour of these towards hydrogen peroxide, and of tincture of guaicol and hydrogen peroxide; of the analogy between the action of enzymes and that of ordinary catalysers; and lastly, of the chemical dynamics of enzyme actions, the author describes the results of a large series of experiments which he has carried out on the action of blood (defibrinated) on hydrogen peroxide. Experiments showed that the decomposing action of blood on hydrogen peroxide is due not to the hæmoglobin but to an enzyme which the author has succeeded in obtaining in aqueous solution, in a fairly pure state. This enzyme he calls, at the suggestion of Ostwald, *hæmase.* It was further found by the author that the power which blood has of giving a blue colour with hydrogen peroxide and tincture of guaicol has no connection with its power of decomposing hydrogen peroxide, or, in other words, is not due to the hæmase. The author has not determined to what the property is due, but considers that it is most probably due to another enzyme. Similarly, in the case of solutions of indigo sulphuric acid, which are decolorised by blood in presence of hydrogen peroxide, but not by hæmase. *Quantitative measurements of the velocity of decomposition of hydrogen peroxide.*—By carrying out the measurements at 0° with very dilute solutions of hydrogen peroxide, the catalysis of hydrogen peroxide by hæmase could be measured without the reaction being disturbed by the oxidation of the enzyme. This reaction was found, in neutral or acid solution, or in presence of salts, to be one of the first order. If the hydrogen peroxide solutions were sufficiently dilute ($\frac{1}{300}$ to $\frac{1}{1100}$ molar), the catalysis of the hydrogen peroxide by hæmase was found to follow the law of mass action $-\frac{dC_{H_2O_2}}{dt} = kC_{H_2O_2}C_{\text{enzyme}}$. In more concentrated solutions, however ($\frac{1}{100}$ to $\frac{1}{300}$ molar), deviations occur in such a sense that the reaction takes place more quickly in the more dilute solution. The ratio of the velocities at 0° and 10° is 1·5. Measurements of the velocity of decay of activity were also made at 45°, 55°, and 65°, and it was found that this velocity increased rapidly with the temperature. Acids and alkalies have a retarding effect on the action of hæmase, without, however (at the concentration employed), causing a permanent change in the hæmase. Potassium nitrate and chlorate in very dilute solutions have a strongly retarding influence on the reaction. The action of aniline and of hydrocyanic acid were also investigated, and it was found that the former is a feeble, the latter a very powerful retarder. From his investigation the author concludes that there is no essential difference between the action of enzymes and that of inorganic catalysers, *e.g.*, Bredig's colloidal platinum.

A. F.

2051. *Rate of Formation of Sulphuric Anhydride in Presence of Platinum.* **G. Bödlander** and **K. Köppen.** (Zeitschr. Elektrochem. 9. pp. 559–568, July 9, 1903.)—The method of experiment which the authors adopt is to heat at a constant temperature mixtures in various proportions of dry sulphur dioxide, oxygen, and nitrogen, the volume of the gas being maintained constant and the progress of the reaction observed by means of the change of pressure. Platinum gauze is used as contact material, as asbestos is attacked by sulphur trioxide. The dissociation of sulphur trioxide is inappreciable below 430°, so that the velocity of formation of the trioxide may be taken as proportional to the product of some powers of the concentrations of the sulphur dioxide and oxygen. The results agree moderately well with the equation for a reaction of the third order: $dc/dt = K(C_{so_2})^2(C_{o_2})$. The velocity of the reaction is increased 1·4–1·5 times for each 10° rise of temperature. The velocity constant is, as would not be expected from theoretical considerations, dependent on the partial pressure of the two gases at the beginning of the experiment. The addition of nitrogen to a mixture of 2 volumes of sulphur dioxide and 1 volume of oxygen accelerates the reaction so that the percentage of sulphur dioxide converted into the trioxide in a given time is independent of the amount of nitrogen present. The velocity of formation of the trioxide is increased by adding an excess of either sulphur dioxide or oxygen, but not to the extent indicated by the theory of reaction velocity.

T. H. P.

2052. *Kinetics of the Carbon Monoxide Detonating Gas.* **H. Kühl.** (Zeitschr. Phys. Chem. 44. pp. 385–459, July 17, 1903.)—The author has carried out a large number of experiments on the velocity of reaction between carbon monoxide and oxygen at temperatures of about 570°, using a lead bath as thermostat and a thermo-regulating arrangement similar to that employed by Bodenstein, and consisting of a porcelain rod acting on a system of levers. The velocity "constant" of the reaction was found to be, on the whole, in agreement with that calculated for a trimolecular reaction, but the results obtained were somewhat irregular. The velocity depends not only, as in other cases of gas-reactions, on the condition of the walls of the reaction vessel, but also, very markedly, on the order in which the different gases were introduced. The initial velocity varies with the concentration of the water vapour present—increasing with increase in the latter. When carbon dioxide is present at the beginning, the initial velocity is retarded. In all cases the initial velocity is greater when oxygen is added to the carbon monoxide than when carbon monoxide is added to oxygen. If dry oxygen is added to moist carbon monoxide, the velocity, in presence of carbon dioxide, is about ten times as great as when moist carbon monoxide is added to dry oxygen. If carbon dioxide is not present to start with, the relative velocities are as 2 : 1. Other irregularities of a similar nature were also met with. The best "constant" was obtained by introducing the previously mixed carbon monoxide and oxygen into the reaction vessel. The author deduces an expression for the reaction velocity, assuming that the following reactions take place: $CO + H_2O = CO_2 + H_2$; $2H_2 + O_2 = 2H_2O$; $2CO + O_2 = 2CO_2$, and that the last reaction is catalytically accelerated by hydrogen. On these assumptions a formula is deduced which has a close formal resemblance to that obtained empirically. Appended to the paper is the deduction of an expression for the reaction velocity when the substances are present in nearly equivalent amounts. **A. F.**

2053. *Density of Fused Salts and Chemical Equilibrium of their Mixtures.* **E. Brunner.** (Zeitschr. Anorg. Chem. 38. 3. pp. 350–376, Feb. 2, 1904. Anorgan. Chem. Laborat. d. Universität, Göttingen.)—The author has determined the density of the following salts in the fused state between the temperatures 800° (or the m.-p. of the salt if higher) and 1000°. The method employed was the determination of the apparent loss in weight of a platinum sinker suspended in the fused salts. The densities of the salts are :—

KCl	$1{\cdot}450 - 0{\cdot}00057\,(t-900)$	Na_2CO_3	$1{\cdot}9445 - 0{\cdot}00040\,(t-900)$
KBr	$1{\cdot}991 - 0{\cdot}00080\,(t-900)$	Na_2SO_4	$2{\cdot}065 - 0{\cdot}00045\,(t-900)$
K_2CO_3	$1{\cdot}900 - 0{\cdot}00046\,(t-900)$	$LiCl$	$1{\cdot}375 - 0{\cdot}00043\,(t-900)$
$[K_2SO_4$	$1{\cdot}96 - 0{\cdot}0005\,(t-900)]$	$[LiBr$	$2{\cdot}30 - 0{\cdot}0007\,(t-900)]$
$NaCl$	$1{\cdot}500 - 0{\cdot}00054\,(t-900)$	Li_2CO_3	$1{\cdot}765 - 0{\cdot}00034\,(t-900)$
$NaBr$	$2{\cdot}2125 - 0{\cdot}00080\,(t-900)$	Li_2SO_4	$1{\cdot}981 - 0{\cdot}00039\,(t-900)$

The values for K_2SO_4 and LiBr were obtained indirectly. The author then used the above method to determine the equilibrium between different reciprocal salt pairs, the amount of interaction being estimated by the volume changes. The salts were taken in equivalent proportions and the temperature was 900°. The composition of the mixtures in equilibrium is as follows :—

$$\left\{\begin{array}{ll} 52 \text{ per cent.} & (KCl + \tfrac{1}{2}Na_2CO_3) \\ 48 \quad ,, & (NaCl + \tfrac{1}{2}K_2CO_3) \end{array}\right.$$

$$\left\{\begin{array}{ll} 63 \text{ per cent.} & (KCl + \tfrac{1}{2}Li_2CO_3) \\ 37 \quad ,, & (LiCl + \tfrac{1}{2}K_2CO_3) \end{array}\right.$$

$$\left\{\begin{array}{ll} 53 \text{ per cent.} & (KBr + \tfrac{1}{2}Na_2CO_3) \\ 47 \quad ,, & (NaBr + \tfrac{1}{2}K_2CO_3) \end{array}\right.$$

$$\left\{\begin{array}{ll} 56 \text{ per cent.} & (NaCl + \tfrac{1}{2}Li_2CO_3) \\ 44 \quad ,, & (LiCl + \tfrac{1}{2}Na_2CO_3) \end{array}\right.$$

$$\left\{\begin{array}{ll} 60 \text{ per cent.} & (NaCl + \tfrac{1}{2}Li_2SO_4) \\ 40 \quad ,, & (LiCl + \tfrac{1}{2}Na_2SO_4) \end{array}\right.$$

From the above it will be seen that the metal with smaller atomic weight tends to combine with the acid radical of higher valency. **A. F.**

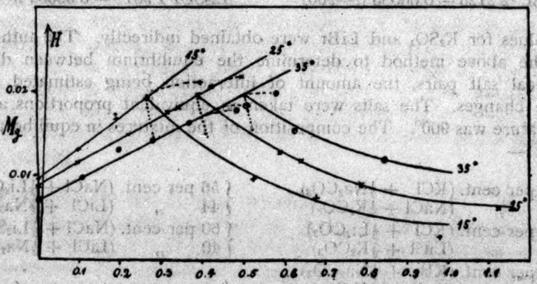
2054. *Theory of Pseudo-Acids.* **H. Kauffmann.** (Zeitschr. Phys. Chem. 47. pp. 618–624, March 31, 1904. Technische Hochschule, Stuttgart, Dec. 6, 1903.)—Hantzsch has stated that it is characteristic of the pseudo-acids that the degree of hydrolysis of the sodium salts is less than that calculated from the dissociation constants of the free acids. From theoretical investigations made by the author, it is concluded that the law of mass action gives no foundation for such a characteristic of the pseudo-acids, the salts of which must be hydrolysed to as great an extent as those of an ordinary acid possessing an equal dissociation constant. The low hydrolytic values obtained by Hantzsch are probably to be explained by incomplete electrolytic dissociation of the salts, or by some other factor not yet understood.

T. H. P.

2055. *Action of Sodium Amalgam on Solutions of Potassium Salts and of Potassium Amalgam on Solutions of Sodium Salts.* **G.McP. Smith.** (Journ. Phys. Chem. 8. pp. 208–213, March, 1904.)—The influence of solutions of potassium and sodium salts in retarding the action of sodium and potassium amalgams on water has been regarded by Fernekes [see Abstract No. 920 (1904)] as in opposition to the ionic hypothesis, which affords an explanation of the effect of sodium salts on sodium amalgam, but not of that of the potassium salts on the same amalgam. The author shows, however, that in the latter case the first action may be regarded as an interchange between the potassium ions of the solution and the sodium atoms of the amalgam; when equilibrium in this action is attained, according to the law of mass action, the sodium-potassium amalgam formed reacts with the water. It is shown experimentally that such a mixed amalgam is formed when a sodium (potassium) amalgam is placed in a solution of a potassium (sodium) salt.

T. H. P.

2056. *Potassium Magnesium Carbonate.* **F. Auerbach.** (Zeitschr. Elektrochem. 10. pp. 161–169, March 4, 1904. Phys.-chem. Abteil. d. Chem. Inst., Breslau.)—The salt $MgCO_3$, $KHCO_3$, $4H_2O$ plays an important part in the separation of purified potassium salts from the Stassfurt salt-beds, and forms the subject of four recent patents. The conditions under which this double-salt is formed are shown by the Fig., which expresses the way in which the molecular proportion of $MgCO_3$ dissolved depends on the proportion of $KHCO_3$ in the solution at 15°, 25°, and 35°. In the earlier stages the solid phase is $MgCO_3$, $3H_2O$, but when the proportion of $KHCO_3$ exceeds about 0·3, 0·4, or 0·5 gm.-mols. per litre at 15°, 25°, or 35° respectively, the double-salt separates, and any further increase in the proportion of $KHCO_3$ in the solution diminishes the amount of magnesium carbonate dissolved.



T. M. L.

2057. *Ferriaceto Compounds.* **A. Rosenheim** and **P. Müller.** (Zeitschr. Anorg. Chem. 39. 2. pp. 175–186, April 2, 1904. Wissenschaftlich.-chem. Laboratorium, Berlin, Feb. 11, 1904.)—If ferric acetate $Fe(C_2H_3O_2)_3$ is allowed to stand with water at about 40° for some considerable time, the basic salt $Fe(OH)_2C_2H_3O_2$ is produced; but if dry ferric hydroxide is boiled for a few hours with glacial acetic acid, part of the ferric hydrate passes into solution and the rest is converted into a crystalline substance the composition of which agrees with the formula $Fe_2(C_2H_3O_2)_5OH$. If this salt is dissolved in water and allowed to stand at the ordinary or at a higher temperature, complete hydrolysis into acetic acid and ferric hydroxide, which remains in colloidal solution, takes place. The progress of this hydrolysis was followed by determinations of the lowering of the freezing-point as well as by conductivity measurements. Although the solution can be boiled without separation of the ferric hydroxide occurring, addition of a small quantity of an electrolyte, *e.g*, NaCl or Na_2SO_4, caused the quantitative preparation of the hydroxide. From a solution of ferric chloride or bromide in glacial acetic acid, ferridiaceto-salts, $Fe(C_2H_3O_2)_2Cl$ or $Fe(C_2H_3O_2)_2Br$, crystallise out. These compounds are salts of a ferridiaceto-kathion, $Fe(C_2H_3O_2)_2^{\cdot}$, which gradually undergoes a partial hydrolysis in aqueous solution. A similar behaviour is exhibited by complex ferriaceto-nitrates and by ferridiformyl chloride $Fe(HCO_2)_2Cl, 1\frac{1}{2}H_2O$. It is therefore very probable that the ferriformic compounds are to be regarded as salts of complex ferriformyl kathions.

A. F.

2058. *Researches on Starch.* **L. Maquenne.** (Annal. Chim. Phys. 2. pp. 109–134, May, 1904.)—In this paper the author gives a short historical sketch of previous work in connection with soluble and insoluble starch constituents, and then gives a connected account of his recent researches on the changes which starch undergoes in solution. His chief conclusions are as follows: Starch in starch mucilage is not a stable substance, but continually tends to "retrograde" or return to the state which it possessed before gelatinisation. This change, though limited, is irreversible. The product is an amorphous substance, not coloured by iodine, not saccharifiable by diastase, and identical with the amylocellulose of Brown and Heron. This substance appears in reality to be a mixture of substances differing in their power of resisting the action of malt extract. The change of starch into amylocellulose is accelerated by a low temperature, by acid, and by alkali at low concentrations. Under the influence of the enzyme amylocoagulase (Wolf and Fernbach) the retrogression is effected in a few minutes. The effect of electrolytes such as acids and alkalies leads the author to think that the phenomenon is only a special case of the coagulation of a colloid.

F. G. D.

2059. *Proposed Explanation of the Agglutination Processes.* **W. Biltz.** (Gesell. Wiss. Göttingen, Nachr., Math.-Phys. Klasse, 2. pp. 157–165, May 20, 1904. Communication from the Chem. Institut d. Univ., Göttingen.)—The author here compares the behaviour of agglutinin towards bacteria with the action of two dissolved colloids on each other [*cf.* Arrhenius, Abstract No. 948 (1904)]. The phenomenon of agglutination comprises two processes, viz., the absorption of serum by the bacteria and the sedimentation of the complex formed. It can be shown now that the phenomenon of sedimentation of a body formed from two dissolved substances can frequently be observed when the two components are in a colloidal state, and that it is unnecessary, or not permissible, to assume a chemical affinity as the cause of sedimentation. As in the case of sera and bacteria, so also in the case of ordinary colloids, one meets with specific actions, some colloids being precipitable by certain other, but not by all other colloids. The author now compares the equilibria curves for the adsorption of hydrochloric acid by the gel of stannic acid; the adsorption of benzopurpurin by aluminium hydroxide; the adsorption of Mo_3O_8 by silk and the distribution of agglutinin between bacteria and solution. All these curves are of the same form, viz., concave to the abscissæ (concentration of the non-absorbed portion in the solution). They can accordingly all be represented more or less closely by the formula $C_1^n/C_2 = K$, in which $n > 1$, and C_1 represents the concentration of the adsorbed, C_2 that of non-adsorbed portion. If the distribution of the dissolved substances is regarded as being conditioned by the adsorbing power of the adsorbing substance one can apply the results observed for ordinary adsorption by colloids to the case of the agglutinins. The adsorptive power of the agglutinable substance (bacteria) is considerable and diminishes with adsorption of agglutinin in such a way that the relative amount of agglutinin adsorbed at higher concentrations decreases, without, however, approaching to a saturation value. It is therefore not necessary to follow Arrhenius in ascribing to the agglutinin a different molecular size in solution and in the bacteria. The value of n will therefore vary with the substances employed. In case of weakened sera it has been found by Eisenberg and Volk that with increasing concentration of the agglutinin solution, the sedimentation of the agglutinable substance, present in constant amount, did not increase to a maximum, but that even with considerable increase of concentration no sedimentation at all took place, so that for these substances there is an optimum point for sedimentation. A similar phenomenon has been observed by the author in the case of inorganic colloids—a fact which speaks very strongly for the relationship of the two classes of phenomena. Further the author points out that since specific colloids (agglutinins) are able to cause the sedimentation of specific bacteria, so for the removal of undesirable colloids definite bacteria must be employed, and this is applied to the purification of water. The author believes that inorganic colloids will be found having a specific action on bacteria and constituting therefore inorganic antitoxins. A. F.

2060. *Study of the Lipolytic Action of the Cytoplasm of the Seed of the Castor Oil Plant.* **M. Nicloux.** (Comptes Rendus, 138. pp. 1288–1290, May 24, 1904.)—It is shown that the action is similar to the action of enzymes. Thus, in the saponification of cotton-seed oil in the presence of dilute acetic acid there is a temperature-optimum at 35° and a cessation of activity at 55°. The cytoplasm retains its activity during the hydrolysis. The velocity of the hydrolysis is diminished by the products of the reaction. For a small amount of cytoplasm acting for short periods the quantity of fat saponified in a given time is proportional to the quantity of cytoplasm present. The velocity obeys V. Henri's equation for comparatively rapid actions. For slower actions the value of the coefficient diminishes with time. In conclusion, the author promises a communication on the effect of water on the action of the cytoplasm. This distinguishes the cytoplasm from all known enzymes. F. G. D.

2061. *Applicability of the Laws of Chemical Equilibium to Mixtures of Toxin and Antitoxin.* **W. Nernst.** (Zeitschr. Elektrochem. 10. pp. 377–380, May 27, 1904.)—The author here criticises in several points the application by Arrhenius and Madsen [see Abstracts Nos. 1110 (1903) and 1553 (1904) of the laws of chemical equilibrium to mixtures of toxin and antitoxin on the ground, first of all, that such reactions, taking place between colloids, are probably irreversible—unless definitely shown not to be so. A number of reactions are cited which point to the irreversibility of the action. The author also criticises the application of the law of mass action, even supposing the reaction to be reversible, in the manner followed by Arrhenius and Madsen, who assumed different values for the equilibrium constant in different cases. The author adopts the adsorption view given by Biltz [see Abstract No. 2059 (1904)], and believes that after adsorption a more radical change occurs, as in the case of the adsorption of a dye-stuff by a fabric. This change or transformation could be measured by change in toxicity, and the author advises such quantitative measurements to be made. A. F.

2062. *The Beckmann Rearrangement: Transformation of Acetophenoneoxime into Acetanilide, and its Velocity.* **C. A. L. de Bruyn** and **C. H. Sluiter.** (Konink. Akad. Wetensch. Amsterdam, Versl. 12. pp. 773–778, May 27, 1904. Translated from Versl. van de gewone vergadering der Wis- en Natuurkundige Afdeeling, April 23, 1904.)—The authors have studied the kinetics of the Beckmann transformation of acetophenone oxime into acetanilide under the influence of sulphuric acid. The experiments were carried out at a temperature of 60° or 65°, and the progress of the reaction was determined by hydrolysing the anilide by boiling with water and estimating the acetic acid. The reaction was found to be monomolecular. At 65° $k = 0{\cdot}0019$ for a solution of 2·5 gm. of the oxime in 50 as well as in 100 c.cm. of 93·6 per cent. sulphuric acid. Time for half transformation equals 160 min. The transformation velocity increases with the concentration of the acid as follows (temp. 60°):—

Concentration of H_2SO_4.	Velocity Constant.	Time of Half Transformation.
93·6 per cent.	0·0011	275 min.
94·6 ,,	0·0013	232 ,,
97·2 ,,	0·0038	75 ,,
98·7 ,,	0·0070	43 ,,

At 65° an 86·5 per cent. sulphuric acid gave a constant 0·0006 (time of half transformation = 501 min.). When using 99·2 per cent. acid at 60°, practically all the oxime had been converted after 15 min. The temperature coefficient is for 10° about 3. A solution of SO_3 in chloroform did not appear to cause any transformation of the oxime. The authors criticise and reject the views of Stieglitz (Amer. Chem. Journ. 7, 29, 49) as being incompatible with facts. The authors believe that it is probable that in the Beckmann transformation there is a formation of an intermediate compound, but that this formation takes place with immeasurably great velocity. A. F.

2063. *Mutual Transformation of the Two Stereoisomeric Pentacetates of* d-*Glucose.* **C. L. Jungius.** (Konink. Akad. Wetensch. Amsterdam, Versl. 12. pp. 779–783, May 27, 1904. Translated from Versl. van de gewone vergadering der Wis- en Natuurkundige Afdeeling, April 23, 1904.)—In the action of acetic anhydride on *d*-glucose, different isomeric pentacetates are obtained according as anhydrous sodium acetate or zinc chloride is used as catalyser. With the former the *β*-form, m.p. 134°; with the latter, the *a*-form, m.p. 112°, is obtained. The transformation of one form into the other can be accomplished by heating the β-isomeride with zinc chloride or by dissolving it in chloroform containing sulphur trioxide, and is due to an intramolecular migration at the terminal asymmetric carbon atom. In a solution in acetic anhydride, containing about 5 gm. of pentacetate in 100 c.cm. of acetic anhydride, to which about 2 gm. of zinc chloride was added, the equilibrium was found to be at 88 per cent. of α and 12 per cent. of β-isomeride. The velocity of transformation was found to accord with that of a unimolecular reaction, and the value of the sum of the constants of the opposed reactions was found to be 0·0095 at 35° (the time being expressed in hours and ordinary logarithms used), with a concentration of zinc chloride of 2 per cent. At 45° the value was 0·028, so that the temperature coefficient over a range of $10° = 3·01$. The velocity is proportional to the concentration of the zinc chloride. The supposed third isomeride of Faurel has been shown to be a mixture of the other two forms. [See also Abstract No. 415 (1904).]

A. F.

2064. *Electrolytic Reduction of Acid Solutions of Molybdic Anhydride.* I. and II. **A. Chilesotti.** (Accad. Lincei, Atti, 12. pp. 22–26, July 5, and pp. 67–73, July 19, 1903.)—The electrolysis of either a hydrochloric acid solution of molybdic anhydride or a solution of ammonium molybdate in dilute sulphuric acid, using a mercury kathode, gives rise to a solution of molybdenum trichloride, which, when prepared in the dry way, cannot be dissolved unchanged. The close analogy existing between chromium and molybdenum is confirmed by the properties of this trichloride and by the composition of the double chlorides. The potassium and ammonium double salts are extremely soluble in water, giving intensely red solutions, whilst those of rubidium and cæsium are less soluble; these compounds are practically insoluble in alcohol. The aqueous solutions rapidly decompose, but solutions in dilute hydrochloric, sulphuric, or acetic acid are more stable. With concentrated sulphuric acid, these salts give emerald-green solutions. The reactions of solutions of the double compounds with salts of mercury, lead, copper, and silver seem to indicate that all these solutions contain a common complex anion. Oxidising agents decolourise these solutions, but the addition of quantities of nitric acid or hydrogen peroxide, insufficient for complete oxidation, gives, in the inverse order, the same colourations as are obtained in the reduction of solutions of molybdic anhydride.

T. H. P.

2065. *Theory of Difference Currents.* **U. Grassi.** (Zeitschr. Phys. Chem. 44. pp. 460–466, July 17, 1903. Phys. Chem. Institut, Göttingen.)—The author shows that former results obtained with vertical electrodes in wide tubes must have an error, which may reach the second decimal, due to convection currents. To avoid these he employs horizontal electrodes filling the whole tube. The first series are made with the kathode below, the second with this above, but protected by layers of filter paper. As electrolyte he uses saturated KNO_3 in specially purified agar-agar. The results agree with the Nernst-Salomon formula.

H. H. F. H.

2066. *Decomposition of Potassium Cyanide in Plating Baths.* **E. Jordis** and **W. Stramer.** (Zeitschr. Elektrochem. 9. pp. 572–575, July 9, 1903.)—Three silver-plating baths were made up, one with silver chloride and two with silver cyanide. The first cyanide bath was used for control, and a current was passed through the other two as in plating. The two cyanide baths were compared by estimating the potassium cyanide and carbonate every few days for several months. The chloride bath was examined in a similar way. The gain in carbonate was calculated as cyanide and added to the amount of cyanide present at the end of the period under consideration. It was found that at first carbon dioxide was taken up without the corresponding amount of cyanide being lost. Afterwards the cyanide disappeared more rapidly than the carbonate increased, showing the presence of bye-reactions. The loss of cyanide and gain of carbonate are greater for a working bath than for one not in use, and greater still for a chloride bath. Reducing agents, with oxalic and acetic acids, were found in the baths. A fuller explanation of these phenomena is to be found by measuring the anode and decomposition potentials. Tables are given. F. S.

2067. *Electrolytic Estimation of Minute Quantities of Arsenic.* **T. E. Thorpe.** (Chem. Soc., Journ. 83. and 84. pp. 974–986, Aug., 1903.)—The apparatus consists of a small stoppered glass cylinder fitting closely but easily into a Pukal cell. The cylinder is provided with a stopper into which are fused a platinum wire, a tap funnel, and a delivery tube. A bell-shaped platinum kathode is suspended from the wire, and reaches nearly to the bottom of the porous cell. The cell is placed in a beaker and surrounded by a platinum cylinder to serve as anode. The inner and outer cells are partly filled with dilute sulphuric acid (1 : 7 by volume). The temperature is kept below 50° by placing the arrangement in water. The resistance is 1·4 ohms, and in practice a current of 5 amps. is used, giving about 40 c.cm. of hydrogen per min. After allowing the current to run for a short time, the liquid to be tested is introduced through the tap funnel, and the hydrogen passed through a heated capillary tube for half an hour. The tube is then sealed off and compared with the standard. Details are given for the preparation of the material for testing; one advantage of this method is that organic matter need not be destroyed. F. S.

2068. *Reaction Acceleration and Retardation in Electrical Reductions and Oxidations.* **R. Russ.** (Zeitschr. Phys. Chem. 44. pp. 641–720, Aug. 18, 1903. Chem.-techn. Institut d. Techn. Hochschule, Karlsruhe, 1902.)—The depolarisation produced by nitrobenzene, *p*-nitrophenol, sodium hypochlorite, and quinhydrone with electrodes of various metals, principally gold, platinum, silver, iron, and nickel, has been measured. In general it is strongest with gold and weakest with nickel. The influence of the material of the electrode on the reduction is not constant but can be rendered greater by prolonged kathodic polarisation, the polarisation being thereby diminished; this action is, however, of an unstable nature, the activity of the electrode gradually, and sometimes suddenly, disappearing as the current is diminished. The curves of current potential (or concentration potential) are very regular, and are mainly logarithmic functions for those electrodes whose capacity for depolarisation is relatively high. At the other electrodes the depolarisation is less and the curve more irregular. These latter electrodes are especially amenable to the action of preliminary polarisation, which causes their depolarising capacity and curves of current potential to approximate to those of the first electrodes. The retarding and accelerating influences of the material and of the previous treatment of the electrode may be referred to two different actions, for they alter the curves in two different ways—by parallel displacement and by change of curvature. These changes are expressed mathematically by changes in two constants of the functions which may be calculated from the curves. These two influences may act in the same sense (as with gold in acid solutions of nitrobenzene), or in opposite senses (as with iron in alkaline solutions of nitrobenzene), in which case either the one or the other may predominate. Gold, especially electrolytic gold, gives far less polarisation than platinum when used as electrode in the electric reduction of nitrobenzene in acid solution or the electric oxidation of quinhydrone. This action possesses the character of a catalytic acceleration. T. H. P.

2069. *Electrolysis of Fused Organic Salts.* **E. Berl.** (Ber. Deut. Chem. Gesell. 37. pp. 325–331, 1904.)—Owing to the fact that nearly all fused organic salts begin to decompose at a temperature little above their melting-points, and also because they are bad conductors, satisfactory results in the electrolysis of such salts are difficult to obtain. When fused sodium acetate is electrolysed, using a current of 0·2 amp. at 8 volts, a gaseous mixture consisting of 20·86 CO_2, 43·56 per cent. H and 25·92 of methane is obtained. The author shows that the hydrocarbon, which is in this case set free at the kathode, is produced by the action of the metallic sodium on the fused salt, which gives rise also to sodium carbonate and carbon. Potassium acetate gives the same products, while potassium propionate gives 70·4 per cent. H and 20·8 per cent. ethane. Schall and Klien's observation of the production of nitrobenzene from potassium *o*-nitrobenzoate is confirmed, and shown to be due to the action of metallic potassium on the fused salt. L. H. W.

2070. *Decomposition Curves of Lithium Chloride in Alcohol. Electro-deposition of Lithium.* **H. E. Patten** and **W. R. Mott.** (Journ. Phys. Chem. 8. pp. 153–195, March, 1904. Abstract in Electrochemical Industry, Vol. I., No. 12.)—This work deals with the separation of lithium from solutions of its chloride in water (45), and in ethyl (2·475), propyl (3·72), butyl (9·56), amyl (3·26), and allyl (4·20) alcohols, glycerol (4·14), and phenol (1·89); the numbers in brackets represent the percentage solubilities of the chloride in the various solvents. In order to obtain practical results, saturated solutions and high voltages must be employed. The observed polarisation and decomposition values (with platinum electrodes) are given in the form of both tables and curves. Separation of the alkali metal takes place as soon as the velocity of deposition exceeds that of solution. The slight polarisation in the alcoholic solutions for moderate current densities shows that the solvent is not decomposed simultaneously with the lithium chloride, but this does not prove that the solvent takes no part in the process. The single potential of the lithium, calculated from thermal data, from the decomposition curves and from the discharge potential, has the mean value 2·41; the observed value in a saturated acetate solution is 2·53 volts. In the deposition of metals, the following factors take part: decomposition voltage, concentration, nature of acid radical, conductivity, current density, products deposited at the anode and corrosion of the latter, chemical constitution of the kathode and velocity of the action of the solution on the metal. The effects of all these factors on the electrolysis of lithium chloride are explained. High current density and good conductivity may compensate, or more than compensate, for a rapid action of the liquid on the deposited metal. T. H. P.

2071. *Electric Reduction.* **F. Haber** and **R. Russ.** (Zeitschr. Phys. Chem. 47. pp. 257–335, March 1, 1904. Chem.-techn. Institut d. Techn. Hochschule, Karlsruhe.)—The authors combine the different factors (influence of kathode potential, concentration, current density, and nature of the kathode) in electric reduction in a theoretical formula which is qualitatively confirmed by experiments with nitrobenzene and *p*-nitrophenol. In order to make quantitative tests a further variable factor x, always greater than unity, must be introduced into the formula, which then becomes: $E = x \,.\, RT/2 \,.\, \log.$ (I/concentration of depolariser) — a constant, where E is the kathode potential and I the strength of current. Nernst's theory that the velocity of reaction is in reality the velocity of diffusion is discussed, and the conclusion arrived at that the velocity of formation of the reducing phase at the kathode is infinitely great, but that the velocity with which this reducing phase acts on the depolariser is often measurably small. The magnitude x cannot be due to diffusion, since this was practically excluded by efficient stirring, small current density, and high concentration, but depends on the condition of the electrodes (hysteresis phenomena). [See Abstract No. 2068 (1904).] Different hypotheses to explain the variations of x are discussed. Investigation of the system, quinone $+ 2HI \rightleftarrows I_2 +$ hydroquinone shows that of the two reactions taking place, quinone + hydrogen = hydroquinone and iodine + hydrogen = hydrogen iodide, the former has a measurably slow velocity, whilst the latter takes place immeasurably rapidly. The quinone-hydroquinone electrode become polarised according to the above formula, while the iodine-hydriodic acid electrode is not at all polarised; the phenomena at the latter electrode are determined only by the velocities of diffusion and not by those of reaction. T. H. P.

2072. *Theory of Saponification.* **F. Goldschmidt.** (Zeitschr. Elektrochem. 10. pp. 221–222, April 1, 1904.)—From theoretical considerations, Euler [see Abstract No. 1147 (1901)] came to the conclusion that the ionisation of the fatty esters takes place, not into ordinary acid anions and alkyl kathions, but into acyl (RCO) ions of a positive character and alkoxyl ions. The author arrives at the same result independently. Sodium ethoxide reacts instantaneously with a fat, yielding the ethyl ester of the fatty acid and the sodium salt of glycerol. Alcoholic potash acts similarly, the ethyl ester of the fatty acid subsequently undergoing gradual saponification. The best explanation of these results is that the fatty acid radicle behaves as a positive ion; this would be derived from a hypothetical base containing a quadrivalent oxygen atom, the electrolytic dissociation of which is represented thus: $R.C \vdots O.OH \longrightarrow R.C \vdots O^{\cdot} + OH'$. From this standpoint, acetyl chloride is regarded as the chloride of the basic ion $CH_3.CO^{\cdot}$ and acetic anhydride as a compound of the ions $CH_3.CO^{\cdot}$ and $CH_3.CO.O'$, or as acetyl acetate. T. H. P.

2073. *Electro-motive Behaviour of Vanadium.* **L. Marino.** (Zeitschr. Anorg. Chem. 39. 2. pp. 152–169, April 2, 1904. Pharmazeutisch-chem. Laboratorium d. R. Instituto di Studi Superiori, Florenz, Nov., 1903. From the German.)—While vanadium can by chemical methods yield four different types of compounds, viz., VX_2, VX_3, VX_4, VX_5, it can, electrochemically, give only the two types VX_4 and VX_5. This is also in agreement with the unstable nature of the types VX_2 and VX_3. The two processes which occur at the vanadium electrode are independent of the temperature, but are closely related to the nature of the surrounding electrolyte. The one process occurs when vanadium forms an anode in aqueous solutions of salts or in solutions of halogen or oxy-acids. In these cases it dissolves in accordance with Faraday's law in agreement with the symbol $V_{\frac{1}{4}}$. The other process occurs in alkaline solution and in agreement with the symbol $V_{\frac{1}{5}}$. These two processes correspond to two different values of e.m.f. varying from one another by 0·7 volt. The author has in no case found that vanadium becomes passive. The electro-motive behaviour of metallic vanadium exhibits no analogy with that of chromium, but an analogy with arsenic and phosphorus. A. F.

2074. *Electrochemistry of the Compounds of Iodine with Oxygen.* **E. Müller.** (Zeitschr. Elektrochem. 9. pp. 584–594, July 16, 1903. Elektrochem. Laborat. der k. Sächs. techn. Hochschule zu Dresden.)—Starting from the deductions of Luther and Wilson [see Abstract No. 2467 (1900)], and from their measurements on the equilibrium between copper, cupro-ions and cupri-ions, the author gives a scheme for the graphic representation of such equilibrium between several grades of oxidation of an element. He applies it also to the reactions : (1) $I' + 4H_2O + 8\mathrm{F} \rightleftharpoons IO_4' + 8H^{\cdot}$; (2) $I' + 3H_2O + 6\mathrm{F} \rightleftharpoons IO_3' + 6H^{\cdot}$; (3) $IO_3 + H_2O + 2\mathrm{F} \rightleftharpoons IO_4' + 2H^{\cdot}$. In alkaline solutions containing the substances in normal concentration, the e.m.f.'s obtained at platinised electrodes, compared with the normal hydrogen electrode, are 0·227 volt for (2) and 0·513 volt for (3) ; the value calculated from Luther's formula for (1) is 0·2986 volt, the experimental value being 0·387 volt. The graphical representation is used, along with the above values, to deduce the behaviour of acidified solutions of the various iodine compounds. T. H. P.

2075. *Use of Alternating Currents in Chemistry and the Reactions they Effect.* **Berthelot.** (Comptes Rendus, 138. pp. 1130–1133, May 9, 1904.)—When a dextrose solution is subjected to the action of an alternating current, so adjusted that no gas is evolved, the simultaneous reduction and oxidation lead to the formation of alcohol. This same reduction and oxidation also takes place in cases of true electrolysis carried out by alternating currents; in these cases the capability of forming complex ions also plays a part. Thus, in the solution of platinum in potassium cyanide solution, the observed reaction is the sum of $H_2O = H_2 + O$; $O + Pt = PtO$; $PtO + H_2O + 2\,KCN = Pt(CN)_2 + 2KOH$; $Pt(CN)_2 + n\,KCN = Pt(CN)_2, n KCN$. T. H. P.

2076. *Influence of Pressure on the Electromotive Force of Gas Electrodes.* **T. Wulf.** (Zeitschr. Phys. Chem. 48. pp. 87–96, May 10, 1904. Institut f. Physikal. Chemie an der Univ., Göttingen.)—In a specially constructed apparatus, the author has studied the influence of pressure on the e.m.f. of gas electrodes, more especially of electrodes at which hydrogen, chlorine, or oxygen separated. The conclusions at which he arrives are: (1) The point of decomposition observed by means of the galvanometer is the point at which the discharged ions of the gas dissolve in appreciable amount in the metal and the electrolytes, and the point of bubble formation that at which the gas passes out from the saturated solution. (2) The last point depends on the pressure, but the former is independent of this, a behaviour which is in accordance with the fact that the evolution of gas is associated with a large volume change, but not so the solution in the liquid. (3) These two points become further and further separated according as the gas is more or less soluble in the electrolyte. For hydrogen and oxygen, they are, under ordinary pressures, practically identical, but this is not so in the case of the very soluble gas chlorine. (4) The Helmholtz formula giving the relationship between the potential of the hydrogen and the pressure, between 1–1000 atmospheres, was quantitatively confirmed. A. F.

2077. *Density of Aqueous Salt Solutions as an Additive Property. Existence of Hydrated Ions.* **P. Vaillant.** (Comptes Rendus, 138. pp. 1210–1213, May 16, 1904.)—It is found that for solutions of electrolytes, the density may be regarded as the sum of two characteristic moduli, which correspond with the ions of the electrolyte. The value obtained for the modulus of any ion differs the more from the mean value, the more the salt in question is hydrated. For H there exist two series of different values, one for inorganic and the other for organic anions. The numbers arrived at by the author lead to the following conclusions: (1) In the formation of an electrolyte, the combination of the ions takes place without appreciable contraction. (2) The ions are in general anhydrous. Polyvalent ions have a smaller volume than monovalent ones. The density of monovalent anions is about 5, and that of monovalent kathions about 2; H, Li and NH_4 exhibit exceptional values. (3) For certain ions—OH, CO_3, S, F—it is necessary to assume hydration, which, together with the trivalency of F and O, satisfactorily explains the observed values.
T. H. P.

2078. *Electrolysis of Calcium Chloride.* **H. Moissan.** (Comptes Rendus, 138. pp. 1194–1196, May 16, 1904.)—The author has already shown [see Abstract No. 1087 (1904)] that the electrolysis of a mixture of calcium fluoride and calcium chloride when fused in an electric furnace, gives a mixture of metallic calcium and carbide of calcium. Bullier has claimed the priority of this discovery (C.R. 138. p. 904, April 11, 1904), having patented a method for the preparation of carbides by submitting a haloid salt of the metal whose carbide was desired, along with carbon and the oxide of the metal. Moissan now responds that under these conditions only a small quantity of carbide can be obtained. He has repeated several of his previous experiments to confirm this. For example, a mixture of 150 gm. of calcium chloride, 15 gm. of lime, and 5 gm. of petroleum coke in fine powder was used. After fusion the mixture was electrolysed for 2½ hours with 15 amps. at 110 volts. The electrolysis proceeded very irregularly and the resistance of the bath varied greatly. The bath only fused at 740°; it remained doughy, then the carbon floated to the surface and the lime fell to the bottom of the crucible. At the end of the experiment the lower part of the mass with water gave off hydrogen only. Sometimes the gas contained traces of acetylene. The upper part of the product gave a mixture of acetylene and hydrogen. The addition of the lime to the chloride of calcium diminishes both the conductibility and the melting-point of the bath.
W. W. H. G.

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2079. *Spontaneous Molecular Activity of Radium.* **H. Wilde.** (Manchester Lit. and Phil. Soc., Mem. 48. 1. pp. 1–12, Dec., 1903.)—A speculative paper in which the atomic weights of the elements are discussed from the point of view that the elements are produced by polymerisation from certain primary types, and that in radio-active elements the reverse process is in operation.
T. M. L.

2080. *Radio-tellurium.* **F. Soddy.** (Nature, 69. p. 347, Feb. 11, 1904.)—A note on Marckwald's experiments with the body isolated by him from the Joachimsthal pitchblende, in which it is pointed out that the substance appears to be identical with the new element polonium discovered by Madame Curie.
J. J. S.

2081. *Evolution of Matter.* **F. Soddy.** (Nature, 69. pp. 418–419, March 3, 1904. Wilde Lecture delivered before the Manchester Literary and Philosophical Society.)—A summary of the experiments upon radium and other radio-active elements with speculations on the evolution of the chemical elements. J. J. S.

2082. *Fixation of Atmospheric Nitrogen.* **E. Chuard.** (Archives des Sciences, 17. pp. 208–210, Feb., 1904.)—In reviewing some processes for the above purpose, the author notices the production of ammonia when calcium carbide is treated with water, attributing this to the presence of calcium nitride, the nitrogen having been obtained from the atmosphere. He also refers to some recent German patents by Frank and Caro for making cyanides and cyanamides of alkaline earths by means of atmospheric nitrogen. The cyanamide bids fair to be a very useful manure if it can be produced on an industrial scale. F. S.

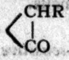
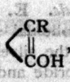
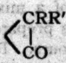
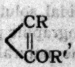
2083. *Oxidase Reactions of Manganese Salts in Presence of a Colloid.* **A. Trillat.** (Comptes Rendus, 138. pp. 274–277, Feb. 1, 1904.)—Albumin, gelatin, and certain non-nitrogenous colloids, such as gum arabic, dextrin, &c., prevent the precipitation of manganous salts by an alkali, and the solutions thus obtained possess properties resembling in many respects the enzymic properties of the oxidases. The author's results confirm the opinion which has been expressed, that the colloidal matter combines with the manganese and keeps it in the most favourable condition for bringing about oxidation. [See also Abstract No. 423 (1904).] T. H. P.

2084. *Refractometric Studies on the Constitution of some Cyano-methinic Acids.* **A. Haller** and **P. T. Muller.** (Comptes Rendus, 138. pp. 440–446, Feb. 22, 1904.)—An attempt to decide between ketonic and alcoholic formulæ for these acids in the free state. Values for six substances agree better with the latter form, but are too high. The high values are probably due to the negative radicals. Other substances are being investigated. H. H. F. H.

2085. *Rusting of Iron and the Passive State.* **M. Mugdan.** (Zeitschr. Elektrochem. 9. pp. 442–455, May 28, 1903. From the Phys. chem. Abteilung des Chem. Instituts d. Universität, Breslau.)—After an exhaustive consideration of previous work, the author investigates this problem by first finding in what solutions iron rusts most rapidly. He then measures the potential of iron in these solutions, and finally examines the passive state. He shows the passive state to be exhibited by other metals besides iron. F. S.

2086. *The Glycolising of Bioses.* **R. Foerg.** (Akad. Wiss. Wien, Sitz. Ber. 112. 2b. pp. 191–197, May and June, 1903. From the Chem. Institut der k.k. Universität in Graz.)—The author undertook the research for the purpose of preparing glycosides of bioses by the action of alcoholic hydrogen chloride on them. He did not succeed, there being always formed the glycosides of monoses. A. F.

2087. *Crystallisation of Difficultly-soluble Bodies.* **A. de Schulten.** (Comptes Rendus, 136. pp. 1444–1446, June 15, 1903.)—The author has prepared barium sulphate in the crystalline condition, by letting a dilute solution of sulphuric acid (2 gm. per litre of water) drop slowly (one to two drops per min.) into a dilute solution of barium chloride (10 gm. in 3 litres of water) heated on a water-bath. At the end of a month, from 8 to 9 gm. of crystals of barium sulphate were thus obtained; the crystals were small, but gave satisfactory crystallographic measurements. In a similar way the following bodies were prepared in the crystalline condition, viz.: celestine, anglesite, hydrargillite, monetite, haidingerite, newberyite, bobierrite, hoernitite, erythrine, annabergite, cabrerite, adamine, and scheelite. D. H. J.

2088. *Influence of the Solvent on the Rotatory Power of Camphor Derivatives.* **A. Haller** and **J. Minguin.** (Comptes Rendus, 136. pp. 1525–1529, June 22, 1903.)—Haller has previously shown [Abstract No. 898 (1904)] that the formation of a double linking in a molecule, such as occurs in the transformation of a keto- into the corresponding enolic-modification, is accompanied by an increase in the rotatory power. The present experiments were made with a view to following, by polarimetric measurements, the increasing formation of the enolic forms of cyano-camphor and camphor-carboxylic acid in different solvents, and so to find the most suitable enolising solvents for these compounds. With cyano-camphor it is found that in benzene and its homologues (non-ionising solvents) the rotation is nearly zero, whilst in other solvents, more especially those of an alkaline nature, it has very high values. Analogous results are obtained with camphor-carboxylic acid. These compounds contain a labile hydrogen atom in the group  $<\begin{smallmatrix}\mathrm{CHR}\\ |\\ \mathrm{CO}\end{smallmatrix}$, which is thus capable of passing into the group  $<\begin{smallmatrix}\mathrm{CR}\\ \|\\ \mathrm{COH}\end{smallmatrix}$, containing a double bond. On comparing compounds containing respectively the groupings  $<\begin{smallmatrix}\mathrm{CRR'}\\ |\\ \mathrm{CO}\end{smallmatrix}$ and  $<\begin{smallmatrix}\mathrm{CR}\\ \|\\ \mathrm{COR'}\end{smallmatrix}$, it is found that the rotations in the different solvents do not vary nearly so much as in the above cases. T. H. P.

2089. *Electrolytic Transport of Certain Ions in Gelatine.* **A. Charpentier.** (Comptes Rendus, 136. p. 1652, June 29, 1903.)—Drops of electrolytes were placed on gelatine and the action of a continuous electric current on them studied. The positive and negative ions are displaced with unequal velocities in opposite directions, and following the lines of force, so that by noticing their lines of movement data can be obtained for the form of the electric field and the velocity of the ions. The order of the velocities determined in this way agrees with that found by Kohlrausch and others. A notable exception was met with in the case of the chromic acid ion, for which a velocity was obtained approximating to that of H· or OH′. This anomaly the author found to be due to electric osmosis, the chromate being transported through a gelatine partition in a direction opposite to that of the current. When a clay partition is employed, however, the direction of transport is in the usual sense, viz., in the direction of the current. The importance of the above behaviour for the study of electrolysis in living tissues is pointed out. A. F.

2090. *New Apparatus and Aids for Electrolytic Analysis.* **H. Paweck.** (Elektrochem. Zeitschr. 10. pp. 243–248, Feb., 1904.)—An illustrated article describing various forms of rotating electrode and apparatus for causing rotation. After referring to the rotating electrodes of Cowper-Coles, Gooch and Medway, and Perkin, the author describes the modified form of the gauze-disc platinum electrode first suggested by him for electrolytic work in 1898. The gauze disc is 5 cm. in diam., and is attached to a length of 0·3 mm. thick platinum wire by welding. This wire serves as axis for the rotation of the disc, and the total weight of the electrode is about 13 gm., while its surface area is 7 sq. cm. A glass beaker containing a cylinder of platinum gauze or foil, inside which this disc can rotate without touching the walls of the enclosure, serves as depositing cell. As attachment for the rotating apparatus the author recommends a special form of mercury cup, and accessories for fixing it upon a retort stand at any height, which cannot be clearly explained without the accompanying sketch. An arrangement for collecting and leading away the gas liberated at the anode during the deposition of the metal at the kathode is also described and illustrated. J. B. C. K.

2091. *Mineral Containing Radium in the Province of Quebec.* **J. Obalski.** (Eng. and Mining Journ. 77. p. 441, 1904.)—The author obtained, ten years ago, a specimen of cleveite from a white mica mine, containing 70·71 per cent. of uranium oxide. On further examination it has been found to contain as much radium as is found in the richest pitchblende. Rutherford found that the specimen, of weight 375 gm., contained 0·1 mgm. of radium. L. H. W.

2092. *Decomposition of Barium Nitrate by Heat.* **B. N. Gottlieb.** (Chem. Zeit. 28. p. 356, 1904.)—When barium nitrate is gently heated for a long time in a current of dry air, 30·7 per cent. of the nitrate is decomposed and 24·6 per cent. of nitric acid recovered. If the temperature is rapidly raised to a high value, 95·6 per cent. of the nitrate is decomposed and 38·6 per cent. of nitric acid recovered. The best yield for technical purposes is obtained by exposing the nitrate to a white heat in small quantities at a time, so that the decomposition takes place before the mass melts. L. H. W.

2093. *Colour-sensitive Silver Chloride.* **E. Baur.** (Zeitschr. Phys. Chem. 45. pp. 613–626, Nov. 24, 1903.)—When colloidal silver solution is treated with less chlorine than is necessary to transform the silver into ordinary chloride of silver, a colloidal solution of a mixture of chloride and subchloride of silver is obtained; photographic plates prepared from this mixture reproduce the spectrum of the sun in the natural colours. The author finds that all mixtures of AgCl and Ag_2Cl act thus, whatever the proportions may be, and he is of opinion that such mixtures are homogeneous. D. H. J.

2094. *Electro-chemical Reduction of Nitro-compounds of the Naphthalene, Anthracene, and Phenanthrene Series.* **J. Möller.** (Elektrochem. Zeitschr. 10. pp. 199–202, Dec., 1903; and pp. 222–226, Jan., 1904.)—Results are given of investigations on the electro-chemical reduction of 1 : 5- and 1 : 8-dinitronaphthalenes, 1 : 5-dinitro-anthraquinone, 2-nitrophenanthrenequinone, and 2 : 7-dinitrophenanthrenequinone. In general, a partial reduction of the nitro-groups in these groups does not take place, and the carbonyl groups are not reduced; the dinitro-compounds yield only diamines, the two nitro-groups being apparently simultaneously acted upon. T. H. P.

2095. *Formation of Urea by Direct Hydrolysis of Lead Cyanate.* **A. C. Cumming.** (Chem. Soc., Journ. 83. and 84. pp. 1391–1394, Dec., 1903.)—Boiling water is found to quantitatively transform lead cyanate into lead carbonate and urea, no ammonium cyanate being formed as an intermediate product. The change can be followed with a microscope, the optically-active crystals of lead cyanate being replaced by amorphous granules of lead carbonate, as the hydrolysis proceeds. Though this reaction with water takes place at all temperatures, it is only very gradual, except near the boiling-point. W. H. St.

2096. *The Elements: Verified and Unverified.* **C. Baskerville.** (Science, 19. pp. 88–100, Jan. 15, 1904. Address of the Vice-president and Chairman of Section C. (Chemistry) of the American Association for the Advancement of Science, St. Louis Meeting, Dec. 28, 1903.)—A review of the criteria necessary for establishing the separate existence of a new element and of the different elements for the existence of which a claim has been made. The address will be chiefly of value on account of the abundant references it contains both to the older and the more recent literature of the atomic theory. T. M. L.

2097. *Reduction of Alkali Iodates and Chlorates with Hydrazine Sulphate.* **M. Schlötter.** (Zeitschr. Anorg. Chem. 38. 2. pp. 184–190, Jan. 18, 1904.)—Iodates and chlorates can be reduced quantitatively by hydrazine sulphate, the reduction in the case of the former being almost instantaneous; in the case of the latter, however, only on boiling for several hours. A. F.